THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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(J. A. BERLY'S).

1909 EDITION

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MUNICIPAL TRACTION.

THE Municipal Tramways Association, which has just held its eighth annual conference in London, may fairly claim to rank as the leading representative body in the British tramway world; and Mr. A. L. C. Fell, as its new President, holding also the important post of chief officer of the L.C.C. Tramways, necessarily speaks with unimpeachable authority on questions relating to tramway problems of the present, while his views on "Tramway Problems of the Future"—the subject of his presidential address—cannot fail to be of interest. That such problems are both numerous and weighty may be readily inferred from the copy of the address before us, though a captious critic would perhaps suggest that the words Past and Present should have been included in the title as well as Future.

The remarkable cessation of activity which descended upon tramway development in the United Kingdom last year calls for comment at the outset of Mr. Fell's address. He regards it as indicating that the rush of construction is over, apparently for good; but is it the fact that we have approached the limit of the possibilities of electric tramway development in this country? When we compare the extent of our systems with those of the United States, for instance, a remarkable contrast is found. The city of Boston alone has a network of tracks of greater aggregate length than those of Glasgow, Manchester and Liverpool combined—our three largest systems outside London—yet the population of Boston is only some 700,000, while that of the three British cities is about two millions. What is the reason of this remarkable difference? Is it due to the fact that the average receipts per passenger in Boston—2½d.—provide a sufficient revenue to cover all outgoings with a good margin, while our standard penny fare—to which the average closely approximates—being less than half the former, keeps the undertakings always within a very narrow margin of profit or loss, and with difficulty provides sufficient allowance for depreciation and renewals? The average dividends on tramway investments have steadily dwindled during the past five years from 4½ to less than 3 per cent., and the average return on the ordinary capital is under 1¾. The falling-off is certainly due in part to the depression in trade, but we strongly suspect that it is in no small degree the result also of excessive lowering of fares or lengthening of stages.

Mr. Fell complains of the burden of cost of paving that is laid upon the tramway authorities, from which their competitors are free. He goes so far, in fact, as to allege that the ratepayers really give a subsidy to omnibus companies

so that they may compete with the tramway undertaking, "which, if owned by the municipality, would relieve the rates." We are not aware that the L.C.C. tramways, since they have been taken out of the hands of the companies formerly owning or leasing them, have ever paid a penny to the relief of the rates; nor do we agree that it is the proper aim of municipal undertakings to do so. Apart from this, however, we see no reason why omnibuses and other public carriages should be specially called upon to contribute to the upkeep of the public thoroughfares, while private vehicles go free. The omnibuses are there because the ratepayers still want them, and it will hardly be maintained that they are less entitled to the use of the roads than the private carts and lorries, which constitute the principal factor in the congestion of our roads. Where the tramway traffic is very heavy, the tramway authority establishes a practical monopoly of the portion of the roadway which it has to pave, and intensifies the wheeled traffic upon the rest of the thoroughfare; in such a case it may be argued that the tramway should contribute to the cost of paving. But the tramcars do not wear the paving, and it is difficult to find any justification for the imposition of the paving charges on tramways where the traffic is light or only moderately heavy.

Mr. Fell deplores the not too friendly relations existing between railway and tramway authorities, and advocates friendly co-operation instead of antagonistic competition—a suggestion which is likely to call forth sardonic comments on the part of the railway authorities. "Our motto," he says, "as far as railways are concerned, should be co-operation not competition." Alas! that we should fall so very far short of our ideal! It is significant, however, that the President expressly excludes the London tube railways from his definition of railway companies. He recommends the latter to devote their attention to the long-distance suburban passenger, and to leave the local traffic to the tramways, which on the average give a journey of nearly 2 miles for 1d.—too cheap, as we have said before.

Amongst other matters touched upon by Mr. Fell were rail-less trolley systems, regarding the value of which he was somewhat dubious; the reports of the Special Committees on Brakes, which, through their want of co-ordination, have had no material outcome; the concessions secured by the Income-tax Sub-Committee; the forthcoming incorporation of the Association; the value of standardisation, in connection with which he advocated the use of the "seat-mile" instead of car-mile in comparisons; through running; trailer cars, which Mr. Fell approves of, and is about to adopt experimentally; conditions of labour, which are complicated in London by the heavy drop of traffic during the middle of the day; conciliation boards, which have been organised in connection with the L.C.C. undertakings; steel-tired wheels, which have been almost universally adopted since Mr. Fell, in 1902, urged their use, in the face of strong opposition; and halfpenny fares. Regarding the last, Mr. Fell unreservedly condemns the system in connection with small tramways, but considers halfpenny fares justifiable in large cities, provided that the stages are kept short.

In conclusion, the President predicts that 20 years hence motor-omnibuses will only be found in museums; all local traffic will be in the hands of the tramways, and the railways will deal only with long-distance traffic; corrugation and other present troubles may be things of the past, but a fresh crop of troubles will have arisen for the Association to overcome.

Buying Coal for what it is Worth.

The Electrical Review has called attention from time to time to the desirability of purchasing steam coal by the B.TH.U., and the practice seems to be growing both here and in the United States, although not much information on this and on other equally interesting subjects is made public by our rather secretive engineers. The *Electric Railway Journal*, of July 31st, contained a long article composed of the specification and conditions of contract issued by a large railway.

Several of the more important electric railways have adopted this scientific method of buying coal, and during the present year the United States Government will buy over half-a-million tons on the B.TH.U. basis. The dearer coals from thick seams have a fairly constant heat value, but the more commonly used thin-seam slacks and coals have no such definite value, and it is to level down the variations of these coals to a common basis that heat value specifications are drawn.

The presence of sulphur in excess is likely to cause heavy clinkering, and damage to the boiler plates or tubes, so the United States Government sets a limit to the sulphur contents, and may reject any delivery in which this limit is exceeded.

For anthracite this limit is 1 per cent., and for bituminous from 1·5 to 3 per cent. Other buyers prefer to exact penalties, which increase at a higher rate than the increase of sulphur. On the other hand, it is not usual to offer premiums for sulphur contents below the maximum.

The percentage of ash is of the utmost importance to the buyer, as it affects directly the thermal efficiency of the coal and boiler. The United States standard for small anthracite is 18 per cent. ash, and an excess of 21 per cent. may cause rejection. Penalties increase at a higher rate than the percentage of ash, but premiums are given at a constant rate.

The percentage of ash in bituminous coal is not an approximate index of the heating value as it is with anthracite, and in the U.S. Government specifications the percentage of ash is used, together with the heat unit content, in comparing tenders. For instance, a coal containing 14,400 B.TH.U. and 8·5 per cent. ash is offered at $4·95 per ton, and a coal containing 14,150 B.TH.U. and 14 per cent. ash is quoted at $4·60.; 2 cents is added to the price of the coal for each 1 per cent. of ash, which, in the example, would increase the cost of the second coal to $4·71. The two coals are now compared on the basis of cost per million units by the formula $\frac{1{,}000{,}000 \times \text{price per ton}}{2{,}240 \times \text{B.TH.U.}}$.

This works out for the first coal at $0·1534, and for the second at $0·1451, thus proving the inferior grade coal the cheapest, so long as it can be fired economically.

It is necessary also to limit the moisture contained in coal, although in some supply stations in Great Britain it is considered wise to damp the coal before firing it. The Third Avenue Railway Co. deducts from the railway scale weights an amount due to all moisture in excess of 4 per cent. with bituminous coal, and 3 per cent. with anthracite, but uses a dry sample for determining the heating value and percentages of ash and sulphur.

In New York, where there are stringent smoke laws, the railway companies set a limit on the volatile constituents of bituminous and anthracite coals, perhaps an easier and cheaper way than buying boilers which will burn the volatile products smokelessly.

Further information on this subject can be gathered from the *Electric Railway Journal* of July 10th, which reported a paper by the general manager of the Eastern Wisconsin Railway and Light Co.

THE MURRAY PHOTO-PRINTING SYSTEM.

This system has been designed to print in Roman type direct from line, using Wheatstone transmitting apparatus and the Morse alphabet.

One of the chief difficulties met with in designing such a system is the extremely short time available for the printing movement. To illustrate this, consider fig. 1, which shows the line currents concerned in sending the two letters A T. At a speed of 100 words per minute, the values of the time intervals are as marked on the diagram. The time intervals are calculated by taking six letters to a word and four dots to a letter.

Consider the spacing interval, equal to three dots, between the two letters. The printing mechanism must not be operated until at least half this interval has expired, since otherwise the apparatus could not distinguish the spaces between the elements of a letter from those between separate letters. Thus only about $\frac{1}{80}$th second is available for the printing movement, and this is far too short to permit any ordinary form of typewriter to be used. It follows that, for high-speed working, some other means of printing must be adopted.

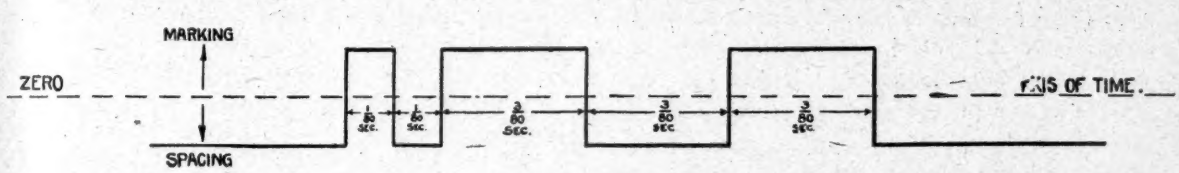


Fig. 1.

In the Murray photo-printer, optical images of the various letters and signs composing a message are successively projected on to a strip of photographic paper, which is afterwards developed and fixed in the usual manner.

The electrical portion of the receiving apparatus is shown in fig. 2.

The six relays D_1-D_6, known as the "dash" relays, are so biased that they are not affected by currents of the duration of a dot. Dash currents, however, last long enough to allow these relays to respond.

The six relays E_1-E_6, known as the "dot" relays, are adjusted to respond at once when a current passes through them.

To illustrate the action, suppose the letter "R" to be received. The first dot causes the tongue of the line relay to move over to the marking contact. This allows a current to flow for the "dot" period from the battery B_1 along the tongue and back contact of relay A_1 and through the lower coils on relays D_1 and E_1 back to the battery. Relay E_1, the "dot" relay, is at once actuated, but relay D_1, the "dash" relay, is not affected. The closing of the contacts of relay E_1 allows a current to flow from battery B_2, through coil C_1 of relay A_1, the upper coil of relay E_1, and back to the battery through the contact points associated with the letter space magnet. The current in the upper coil of relay E_1 locks its armature in position.

It will be seen that when the armature of relay A_1 is attracted, the circuit through the lower coils of relays D_1 and E_1 is broken. The magnet C_1 of relay A_1 is energised directly the dot relay E_1 is actuated. If now relay A_1 were actuated directly the dot relay contacts were closed, a dash signal could not be recorded, since the circuit through the dash relay would be broken before its armature had been attracted. To avoid this, relay A_1 is so adjusted that both its magnets must be energised before the armature is attracted, and the second magnet, B_1, is only energised when the line relay tongue has returned to its spacing contact at the conclusion

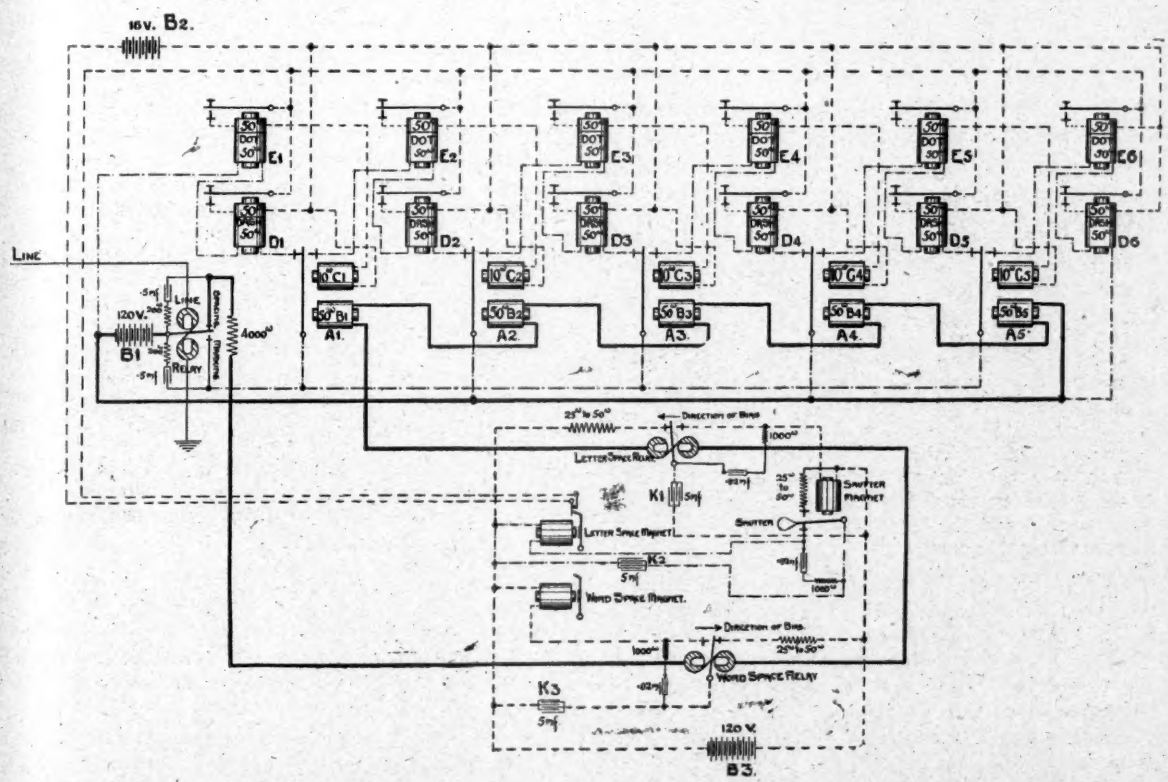


Fig. 2.

The mechanism required to effect the necessary operations is capable of rapid action, and consequently a much higher speed of reception is attainable than would be possible if a receiving instrument with moving parts of considerable mass, such as an ordinary typewriter, were employed.

of the signal. When, however, the armature of relay A_1 has been pulled over, the coil C_1 is sufficient to retain it in position.

At the conclusion of the dot signal which we are considering, the line relay tongue returns to its spacing contact, and relay A_1 is actuated. The armatures of relays E_1 and A_1 are both locked in their attracted positions. When the line relay tongue moves over to the marking contact under the influence of the next signal, a dash, a current flows from the battery B_1, along the tongue and front contact of relay A_1, through the lower coils of relays E_2 and D_2, and through the back contact and tongue of relay A_2 back to the battery. Relay E_2 responds at once, and, when the signal has lasted sufficiently long, relay D_2 is also actuated.

The closing of the contacts of relay E_2 causes a current to flow from battery B_2 through coil C_2 of relay A_2, the upper coil of relay E_2, and back to the battery through the contact points of the letter-space magnet. Relay E_2 is thus locked. At the same time a current from battery B_2 flows through the locking coil of relay D_2, the armature of which is, therefore, also retained in its attracted position.

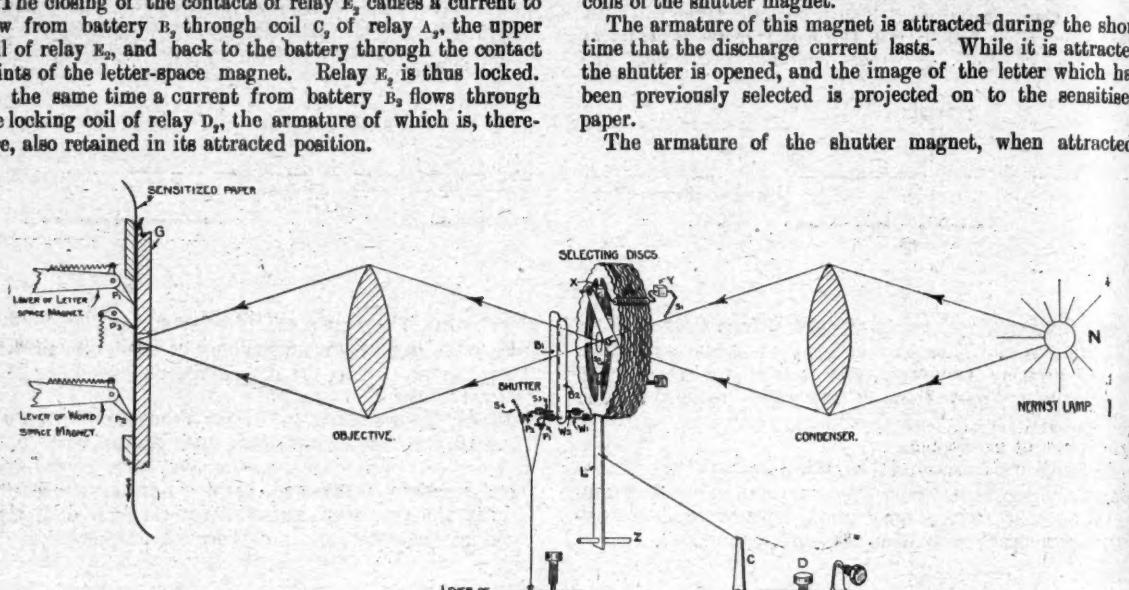


FIG. 3.

At the conclusion of the signal the line relay tongue returns to its spacing contact, and allows a current to flow from battery B_1 through coil B_2 of relay A_2. Both magnets of this relay being now actuated, its armature is attracted, and is locked in position by the current in coil C_2.

The next signal, a dot, will cause relay E_3 to be actuated, and at the conclusion of the signal the armatures of relays E_3 and A_3 will be locked in the attracted position, in the same manner as has already been described for the first two pairs of relays.

In the case of the letter R this completes the selecting process. The selecting process for any other letter or sign with more than three elements in its Morse equivalent is simply a continuation of the same actions. Since no letter or sign in the Morse alphabet consists of more than six elements, either dots or dashes, it follows that the six dot relays E_1—E_6 and the six dash relays D_1—D_6 meet all requirements. These twelve relays are in connection with the printing mechanism, which is so arranged that when the dot and dash relays corresponding to the letter or sign required have been actuated as described, a small diaphragm bearing that particular letter or sign is placed in position, like a lantern slide, in front of a source of light, so that its image can be projected by suitable lenses on to the photographic paper. A shutter is, however, interposed. As soon as the letter has been transmitted, and the selecting mechanism set, as described, the shutter is actuated and the sensitised paper exposed, and immediately afterwards the paper slip is moved forward in readiness for the next letter.

These last two actions are controlled by the "letter-space" relay. It will be seen from the diagram that when the line relay tongue is on its spacing stop, the current which is flowing from battery B_1 through the lower coils of relays A_1—A_6 also passes through two P.O. standard relays, known as the "letter-space" and "word-space" relays respectively. The letter-space relay is so adjusted, by increasing the play of the tongue between the contact screws, and also increasing the bias, that it will not close its local circuit under the influence of the short current sent through it during the dot spaces between the elements of a letter, but will respond to a current flowing for a period equal to about two dots. The spacing current between letters flows for a period equal to three dots, and thus at the end of a letter the letter-space relay is actuated.

While no current is flowing through this relay the battery B_3 is joined through the tongue and spacing contact to the condenser K_1, which is thus kept charged. When the letter-space relay is actuated, condenser K_1 discharges through the coils of the shutter magnet.

The armature of this magnet is attracted during the short time that the discharge current lasts. While it is attracted the shutter is opened, and the image of the letter which has been previously selected is projected on to the sensitised paper.

The armature of the shutter magnet, when attracted, joins the battery B_3 to the condenser K_2. Although the armature only remains attracted for a very short period, it is long enough to allow this condenser to be charged. When the armature returns to its back stop, condenser K_2 discharges through the coils of the letter-space magnet. The armature of this magnet, when attracted, moves the paper forward one letter space, and also opens the two contacts shown associated with it. The current which is locking the various relays in position, passes through these two contacts, so that when they are opened all the relay armatures are released and return to their normal position. Everything is now in readiness to receive the next letter.

If the letter, of which the reception has been traced, had been the final letter of a word, the space between it and the first letter of the next word would have been equal to five dots.

The "word-space" relay is adjusted so as not to respond to a "letter-space" current of three dots duration, but to respond to a current between three and five dots in length. Consequently at the conclusion of a word, after the actuation of the letter-space relay (which moves the slip forward one letter space), the word-space relay is actuated. This allows the condenser K_3, which while the word-space relay is in its normal position is kept charged by the battery B_3, to discharge through the word-space magnet, and thus the slip is moved forward another letter space.

Resistances are inserted in the charging circuits of condensers K_1, K_2 and K_3, to prevent the welding of the relay contacts which would otherwise result from the excessive rush of current when the charging battery is first joined up.

The resistances and condensers joined across the contact points of the letter and word space relays and of the shutter magnet are to prevent sparking at these points.

The arrangement by means of which the actuation of the

dot and dash relays corresponding to any particular letter causes that letter to be placed in position in readiness for projection on to the sensitised paper, is shown in fig. 3.

The selecting disks consist of 11 wheels made of thin sheet-brass mounted on a tubular axle. The periphery of each of these wheels is cut into a series of open V-shaped notches with rounded edges. The object of these notches will be explained shortly.

Round the circumference of these disks, and lying across their edges, is placed a series of rollers, one roller being provided for each letter or sign which the instrument is arranged to print. One of these rollers is shown at A.

Each roller consists of 11 small steel disks threaded on a wire shaped as shown, which is supported at the points X Y in holes made through the edges of two brass disks fixed concentrically with the selecting disks. To one end of this wire a light spring, S_1, is attached, the other end of which is fastened to a pin fixed in the face of the brass disk which provides the bearing Y. The other end of the wire carries a mica vane carrying a letter or sign, as shown in the figure. This letter is formed of clear mica on an opaque ground. The method of printing the letter on the mica vane will be described later.

It will be seen that the spring S_1 tends to make the roller move inwards towards the centre of the disks, and thus to swing the letter into the axis of the tubular axle. Normally, however, the edges of the brass selecting disks prevent this movement from taking place. If, however, the disks be so moved relatively to one another that in each disk a V notch comes below the particular roller under consideration, the spring S_1 can pull the roller down, and the corresponding letter is then placed in position on the axis. The selecting wheels are so arranged that, when the apparatus is at rest, the notches coincide under the roller corresponding to the letter E, which is consequently depressed. The displacement of any disk causes the continuity of the groove formed by the notches across the edges of the disks at the E position to be broken. The edge of the notch in the displaced disk forces up the roller, and so removes the letter E from the printing position.

The movement of the selecting disks is effected by the dot and dash relays, each disk being controlled by one relay. The first dot relay is not, however, connected to a disk, because, as already mentioned, the letter E is normally in position for projection on the paper. As shown in the sketch, the pivot of the dot or dash relay carries an upright arm, which is attached by a fine wire to a lever L, pivoted at Z.

The upper end of the lever L rests in a notch cut in the selecting disk. The V notches in the various disks are so arranged that, when the dot and dash relays which make up the Morse equivalent of any letter are actuated, a continuous groove is formed under the roller corresponding to that letter. The roller is consequently depressed, and the mica vane bearing the letter is moved into the printing position on the axis. At the same time, the mica vane bearing the letter E is moved away from the axis, as already explained.

After the exposure, when the selecting magnets are released, each disk is returned to its normal position by the action of a spring, which has one end attached to a spoke of the disk and the other fixed to a pin inserted in the framework of the instrument. The spring controlling the left-hand disk is shown at S_3 in the sketch.

When a disk is thus drawn back to its normal position, the armature of the corresponding selecting relay is lifted up and banks against the screw D.

In addition to these springs the armature of each dash relay is provided with a second antagonistic spring. These latter springs are all joined by silk threads to a long axle which can be turned by a milled head. When the axle is rotated the silk threads are wound up, and thus the bias of all the dash relays is simultaneously varied.

The shutter, which allows the image of the letter to fall on the sensitive paper, consists of two blackened mica vanes, B_1 and B_2, which are normally held in a vertical position slightly overlapping one another. These vanes are fixed to two wire axles, W_1 and W_2, shaped as shown. The springs S_3 and S_4 normally hold the wires W_1 and W_2 up against the stop-pins P_1 and P_2.

When the shutter magnet armature is attracted, the ends of the axles W_1 and W_2 are drawn towards each other. This moves the tops of the mica vanes apart, thus allowing the light from the lamp N to pass and the letter to be registered. The condenser and objective fulfil the usual functions of these lenses in an optical lantern. The condenser is a Watson's "Micro-Illuminator," designed as a con- for microscope work. The objective may be any good lens.

The source of light which has been used is a one-ampere, single-filament, Nernst lamp.

The sensitised paper is contained in a light-tight box. The paper feed arrangement is shown on the left of fig. 3. The slip passes down behind the glass plate G, against which it is held by the three pawls P_1, P_2 and P_3. A small square hole is cut through the glass where shown, to allow the light to fall directly on the paper.

The pawl P_1 is carried on the end of the letter-space lever. Pawl P_2 is similarly carried on the word-space lever. Pawl P_3, fixed on the framework of the instrument, prevents the paper slip from running back.

(To be concluded.)

THE ENGINEERING SECTION OF THE BRITISH ASSOCIATION AT WINNIPEG.—I.

[BY OUR SPECIAL COMMISSIONER.]

The Section had a particularly busy meeting, a large part of the time being occupied with what is the main question of the country—the production and transport of grain, and the improvement of communications. Sir William White's presidential address was a review of the commercial position of Canada from the point of view of trade communications, and formed a very appropriate introduction to the closely-connected group of papers on the same general subject which followed it. We intend to return to this topic and deal with it more fully in a subsequent article.

Of the rest of the proceedings the most important paper was contributed by Col. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission, on the "Engineering Works of the Panama Canal." The paper, which was very long and profusely illustrated by photographs and copies of official surveys and plans, was summarised by Lieut. Goethals, who is engaged under his father on the Canal works, in a lecture of an hour and a half. The Panama Canal is, of course, an extraordinarily interesting piece of work, alike from its history, from the effect it will produce on commerce and politics, on which we can at present only speculate, from the mere engineering interest, and from the economic and hygienic questions which have proved to be the key to its successful construction. Col. Goethals, in a striking passage, closing his paper, says that there have been no new engineering problems, that all the difficulties are administrative. In a sense that is true, but it is only true from the point of view of an administrator.

As regards the canal itself, it will be sufficient to recall here that it will be 50 miles long, with a rise to the summit level of 85 ft. in three locks on each side, and that the tide range is about 2 ft. on the Atlantic and 21 ft. on the Pacific side. The locks have a usable length of 1,000 ft., are 110 ft. wide, and have a depth of 41 ft. over the sills, and that depth of water is maintained throughout the canal. All the locks are twin, allowing two vessels to pass up or down at once, and each lock of 1,000 ft. is divided by a central pair of gates into two sections usable by vessels of 350 ft. and 550 ft. respectively, so that small or moderate vessels can pass the locks with the loss of less water from the summit level than if the whole 1,000 ft. locks were employed. It was said that 95 per cent. of present ocean-going ships are less than 600 ft. length. The excavation for the Gatun locks, three twin pairs in flight, on the Atlantic side, seems to be completed, and the machinery for building the concrete work erected. This is on a very large scale, and the detail has been closely thought out, so that the materials are brought

to the site, and the charges of rock, sand and cement, properly proportioned, mixed, and poured with the utmost rapidity and ease. The whole site is commanded by ropeways carried by movable steel towers and operated electrically. Constructional work of this kind lends itself to description better than excavation or dam building, and the operations were fully illustrated by photographs and by working plans. They are, however, on too large a scale to be easily realised.

Much consideration has been given to precautions against ships breaking down the lock gates by accident. The most important gates are the upper and lower gates of the locks next to the summit level on each side, since the destruction of one of these may cause a flood. These, in all cases, will be in duplicate, and in addition emergency dams are provided above the locks; but the most effective precaution would seem to be the practice of bringing every ship to alongside a quay wall in line with one side of the lock before she is allowed to enter, and then warping her through by electric capstans without using her own engines. This should save any chance of such an accident as occurred earlier in the year at the Soo, when a ship moving under her own steam charged the lower gate of a lock on the Canadian side when the upper gate was still open. The cause in that case, we believe, was with the engine-room telegraphs.

The main problems of the Panama Canal were the provision for the excessively heavy and sudden floods of the Chagres River on the Atlantic side of the divide, and of the smaller Cocoli River on the Pacific side; the provision of sufficient storage of water to work the locks and provide for losses if a locked canal were used; or, in the alternative, the enormous and difficult excavation required for the Culebra ridge, and, indeed, of the whole route, if a sea level canal were preferred.

The American engineers, having the previous experience of the French to go on, have dealt with these questions by designing the great Gatun dam, forming a lake 163 square miles in area at the summit level of the canal. This lake can receive the violent floods of the Chagres and other mountain streams without any risk of damage to the canal works, and is itself controlled by weirs, built in a natural hill forming part of the Gatun dam, which discharge into the present Chagres bed, and away from the canal, into the Caribbean Sea. It also provides ample storage water for the dry season for lockage and waste. A smaller lake, Miraflores, lying below the upper and above the two lower locks on the Pacific side, provides in the same way for the floods of the Cocoli. The excavation of the Culebra cut, which, on the proposal of a sea level canal, would have been enormously heavy, is reduced by the plan of the summit lake to manageable though still vast dimensions. The figures of these excavations may be given, though they are hardly realisable.

The total excavation at the summit level will be 150 million yards. The French removed 40 millions; the Americans have removed another 50 millions since 1906, and 60 millions remained last June still to be excavated. Electricity is used to operate the ropeways and concrete machinery at the Gatun flight of locks on the Atlantic side, and will be used similarly at the locks on the Pacific side when their construction begins. Two large generating stations are designed to provide the power for working the locks, and working the vessels through, as well as for lighting and other purposes connected with the operation of the canal. It is reckoned that the canal will pass 80 million tons of shipping per annum, or four times the present tonnage of the Suez Canal.

In electrical papers the Section was somewhat weak. Mr. Ormond Higman contributed an historical account of the work of the International Electrotechnical Commission, and a group of three papers on subjects connected with three-phase distribution lines were read by Prof. Marchant, Prof. Thornton and Mr. E. A. Watson. Prof. Thornton's was an account of an experimental investigation of the electrostatic field between three wires by Hele-Shaw's method of drawing stream lines. It was a good example of the use of the method, but as the author observed, there is no useful present application of the results. Dr. Marchant gave formulæ for the capacity of a three-phase aerial line, useful as giving the value of the capacity currents. Mr. E. A. Watson gave an account of experiments on the critical pressures at which leakage by aerial discharge begins, and the effect of the condition of the wires. In Canada, as no doubt in the United States, the greater part of the work of electrical installations falls to the civil engineers and the manufacturers, and the independent electrical engineer, as such, would generally find employment only on special points. There are large water powers all over the country, often of very moderate heads, and there seems to be no limit to the use that may be made of them. Sir William White, in his presidential address, mentioned that the water powers in the Province of Quebec alone were estimated at 13 million H.P., and it is said that the Georgian Bay Canal will make 1 million H.P. available. Civil engineers with experience of the utilisation of such falls, and manufacturers of electrical and turbine machinery should find much employment in the near future. A visit to a large hydro-electric plant now being constructed for supplying Winnipeg was arranged for members of the Association, and we shall allude further to this plant next week.

Prof. Foster, of McGill University, Montreal, gave some account of an investigation now being made for the Dominion Government of the properties and qualities of the coals found in Canada. Canada possesses coalfields on the extreme east in Nova Scotia and New Brunswick, and on the extreme west in the Rockies, and nearer the Pacific Coast; but excepting deposits of lignite in Manitoba, there is no coal between. The central regions of Canada, and the steamers plying on the great lakes, draw their coal supplies from the Pennsylvania fields through Cleveland, on Lake Erie; and this trade has an important bearing on the general traffic problem which will be dealt with later. The coals from Eastern Canada are bituminous, but in the Cordilleran region every variety of coal is found between lignite and fine anthracite. The examination of all these coals is being very thoroughly carried out. They are tested on a working scale, in raising steam in full sized boilers and in gas producers; and their coking qualities are tested in actual operative coke ovens. Large samples of each kind are handled, hundreds of tons being taken if required. The value to the Dominion of this work when completed should be very great.

Another paper that requires notice here was contributed by Col. Ruttan, the city engineer, on a plant recently completed for supplying Winnipeg with water at high-pressure for fire purposes. The water of the Red and Assiniboine rivers, at whose junction Winnipeg stands, is so heavily charged with silt that it is quite unfit for domestic purposes until thoroughly filtered, and is not satisfactory then. It was used until 1899 when the first artesian well was made, and now a supply sufficient for domestic purposes (and more than sufficient for medicinal purposes) is given at 100 lb. pressure from that and other wells sunk since. The supply was not, however, nearly sufficient for fire purposes, and fires are so frequent and destructive in Winnipeg that an additional supply was imperatively required. Indeed, the fire insurance rates that obtained there would shock an English house owner. The present system was accordingly established to pump water at high pressure into the city from the Red River. The plant consists of six gas engines, two of 250 B.H.P., and four of 500 B.H.P., driving pumps having a duty of 9,000 gallons per minute at 300 lb. pressure; a very complete plant of Crossley gas producers and a gas holder; the whole connected to an extensive system of high-pressure mains, with a liberal equipment of hydrants. To meet the condition made by the insurance underwriters, that there should be two sources of power, the city gas supply is connected to the gas-holder, and also directly to the engines, and ample provision is made by duplication of parts to prevent an interruption of the service by accidental breakdown.

A fire, which completely burnt out a large building two nights before Col. Ruttan read his paper, showed how rapidly fire takes hold of the inflammable structures common in Winnipeg, and at the same time how thoroughly it was controlled after the high-pressure hydrants had been started.

Other papers of interest were by Prof. Coker on a method of exhibiting strains in two dimensions by circularly polarised light, and by Mr. C. E. Larard on torsion tests on steel, the results of an elaborate investigation.

Mr. Dugald Clerk contributed a paper on the work of the Gas Explosions Committee, of which he and Prof. B. Hopkinson are secretaries, and a long report of the committee was circulated. The committee was recommended for reappointment with a grant of £75.

THE MANUFACTURE OF ELECTRIC CONDENSERS.

The number of uses to which alternating currents of high frequency and low amperage are nowadays being put in commercial practice, such as their application to induction coils for high frequency medical treatment, post office line practice, and wireless work of all descriptions, has brought the question of economical manufacture of

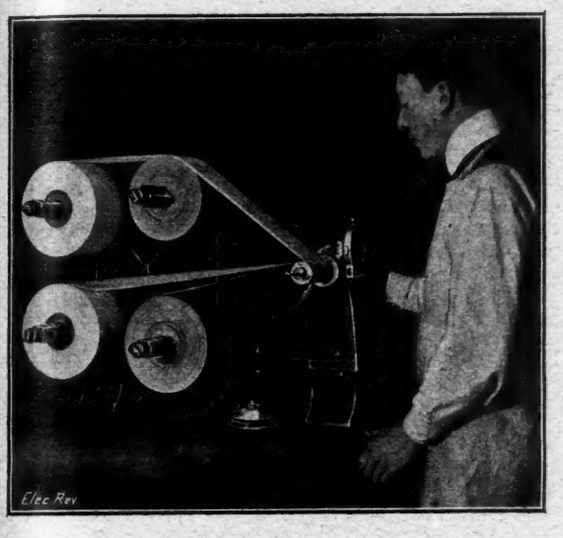


Fig. 1.—Condenser Winding Machine, Operated by Hand.

the condenser once again into a very prominent position. The days are long since passed when the interleaving of tinfoil with sheets of paper in a built-up pile was considered a suitable method of constructing a condenser. Such an arrangement was not only much too cumbersome when built to afford anything like portability, but it was also slow and expensive to make. One principle upon which modern condensers are made is that evolved by Mr. G. F. Mansbridge, in which cartridges or rolls are made up of plain paper and electrically-conducting foiled paper covered with powdered or finely divided tin, rolled together into a cylindrical form. This form of construction produces a very efficient and compact condenser arrangement, the conducting films acting as the electrodes of the condenser, the insulation being provided by means of the plain paper and the backing on which the film is mounted.

In order to manufacture such a condenser, somewhat special apparatus is required, so as to give a uniform and equal tension to all parts of the condenser winding, and to present an even and finished appearance to the cartridges when they are finally assembled. For this purpose, Messrs. Gimson & Co., Ltd., of Leicester, have brought out a series of machines made to the designs of Mr. Mansbridge, which are interesting from the point of view of specialisation in the manufacture of electrical apparatus. The condenser winding machine consists of a framework carrying five spindles, one of these being fitted with a crank and winding mandrel, the other spindles carrying respectively two rolls of foiled paper and two rolls of plain interleaving paper. Figs. 1 and 3 show respectively the machine adapted for hand operation and for driving by motor. The spindles carrying the paper are provided with adjustable band brakes, so that the tension on the paper when winding may be adjusted. The spindles for the plain paper are cylinders 3 in. in diameter, while those for the foiled paper are of square section 1½ in. across, and provided with extending cams, so adapted that they will grip the roll of foiled paper tightly, and thus prevent it from moving sideways during the process of winding. This provision is made in order to obviate spoiling the alignment. For rolling condensers of different sizes interchangeable mandrels of different diameters are provided, and it will be noticed that a revolution counter is provided on the machine gearing with the winding mandrel, so as to indicate the number of turns put on to the mandrel at any time. A fixed pointer is also provided which can be set to the number of turns which it is required to put on any particular pattern of winder, so

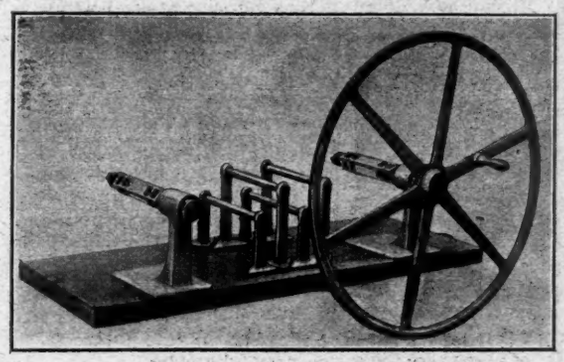


Fig. 2.—Machine for Testing Foiled Paper.

that the machine can be operated by an unskilled attendant. A further device which will be noticed is a bell indicator, which automatically indicates if there is a breakdown at any point in the insulation of the paper strips.

It is important, however, that the strip of paper upon which the finely divided tin is deposited should be thoroughly tested before making up into the condenser in order to eliminate all defects, and for this purpose a second machine is made by Messrs. Gimson, the general appearance of which we illustrate in fig. 2. The process of testing consists of drawing the paper under one and over another roller, the two rollers being connected respectively either to two poles of a battery or to electric light mains, giving a potential difference of about 100 volts.

The paper is first placed in the form of a roll on the square mandrel furthest from the driving wheel, and passed under one roller wheel, over the next, under the third, and over the fourth, and on to a second mandrel connected to the drawing-off hand wheel. The paper is thus drawn over the rollers at a speed of, say, 50 to 100 ft. per minute. When a defective place, for example, a pin hole, reaches the roller which is in contact with the plain side of the paper, there will be a momentary short circuit through the defective place. This causes a rush of current at the defective spot, and sparking results. If suitable means are taken, the rush of current will be insufficient to burn the paper, but will be enough to fuse the minute quantity of tin immediately surrounding the defective place, and thereby to isolate the hole from the neigh

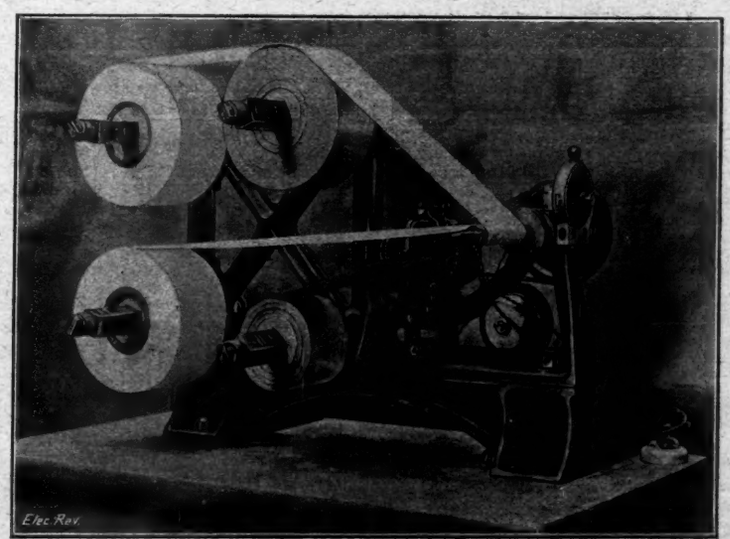


Fig. 3.—Motor-driven Winding Machine, showing Revolution Counter and Bell Indicator.

bouring foiled surface. By thus isolating the defective place, it is in effect eliminated and condensers built up from paper after this treatment, will give a higher insulation and stand a higher voltage without disruptive discharge.

The breaking-down process is quite automatic once the strength of the current has been suitably adjusted. This adjustment is a simple matter, and may be made by means of a resistance of about 20 ohms inserted in series with one pole of the supply. The resistance should be capable of variation until the sparks pro-

duced on the roller appear to be about ⅛ in. high. As a rule, with a 100-volt circuit a resistance of about 15 ohms will produce a satisfactory result, while with 200 volts a resistance of rather more than 100 ohms is usually necessary. Either continuous or alternating current may be used.

Although only two rollers are necessary (indeed, one could be made to answer if a rubbing contact were provided for the foiled paper), yet it is convenient to have four, inasmuch as a test for continuity of the foiled paper can then be made simultaneously with the carrying out of the breakdown process. This is done by connecting a relay or other device between the two rollers which are in contact with the foiled side of the paper, and connecting up a bell, lamp or other device to the relay, so that an indication is given when there is any break of continuity between the two rollers.

The most convenient way is to have the paper drawn past the rollers by means of a small motor and to pass the current driving the motor through the strip of foiled paper which is between the two rollers that are in contact with the foiled side. By this means the motor is deprived of its current immediately there is a break in the continuity of the foiled paper, and therefore stops, and automatically calls attention to the want of continuity.

It will be seen from the above description that a very well devised and thought-out system for producing these condenser spools has been placed on the market, and it would seem that the invention has been well timed to meet an increasing demand for a type of apparatus which, formerly held of little account, nowadays occupies an important position in the sphere of practical electrical engineering.

Premier Accumulators.—The PREMIER ACCUMULATOR CO., LTD., has recently completed the battery for the Tewkesbury Electricity Works, and is now executing orders for a lighting battery for the Chippenham Electricity Works, and a lighting battery for the N.E. Railway.

SIEMENS COMMUTATION-POLE TRACTION MOTORS.

HAVING found the use of commutation poles advantageous in connection with large railway motors, Messrs. Siemens Bros. Dynamo Works have extended the application to their tramway motors; for these a special patented design has been worked out, by means of which the introduction of commutation poles causes very little extra expense and very little increase on the overall dimensions of the motors.

The most obvious benefit gained by the use of commutation poles is freedom from sparking, and the consequent decrease in the cost of maintenance due to this cause; this, however, is by no means the only advantage. As soon as motors were introduced in which there was no fear of sparking, even when 50 per cent. of the field current was shunted, the objections urged against this method of control were no longer valid. Messrs. Siemens Bros. Dynamo Works, therefore, are now putting on the market a controller in which provision is made for shunting the field windings in varying degrees, as required by local conditions; in this way a controller is arrived at in which, instead of there being as usual only two economical running positions, namely, full series and full parallel, there are at least five, for example:—(1) Full series, full field; (2) full series, field shunted 50 per cent.; (3) full parallel, full field; (4) full parallel, field shunted 25 per cent.; (5) full parallel, field shunted 50 per cent.

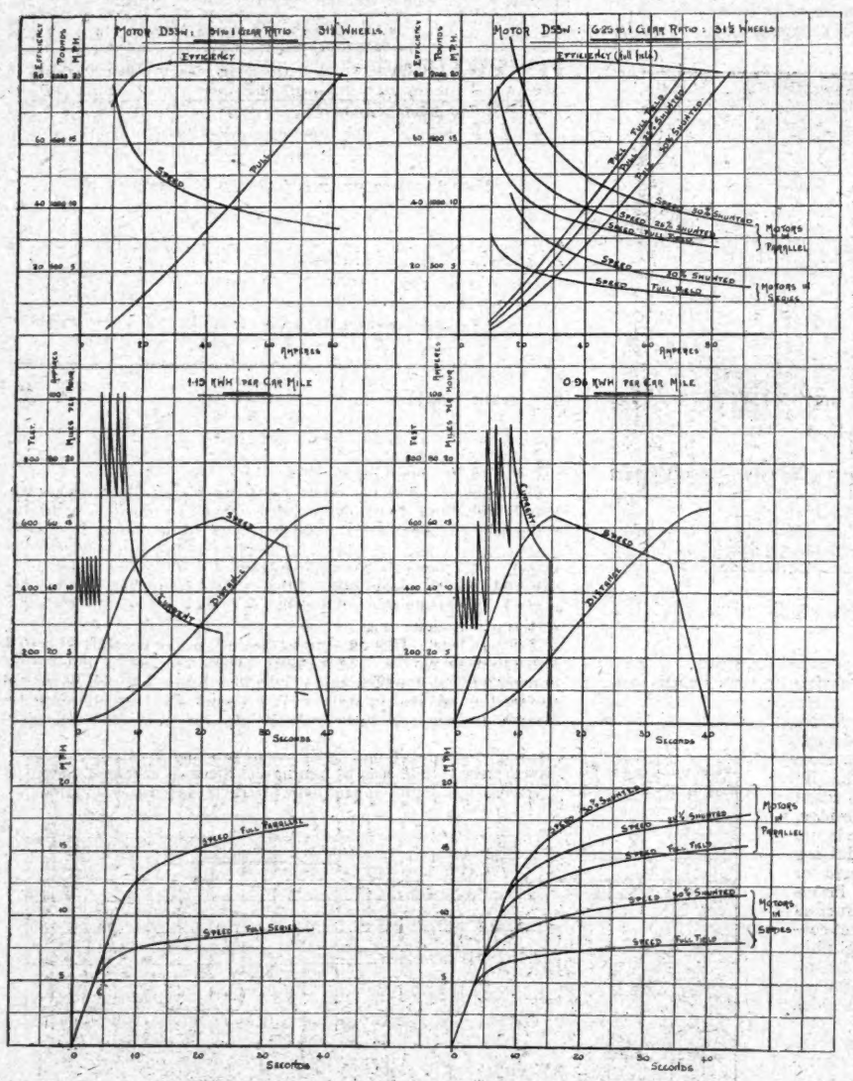


FIG. 1.—PERFORMANCE CURVES OF SIEMENS MOTORS.

In order to illustrate these advantages, the curves shown in the accompanying figures have been prepared. These curves relate to a 10-ton tramcar, equipped with two 38-H.P. commutation-pole motors. Two sets of performance curves for these motors are given, one for the motor geared with a reduction of 97: 19, and the other with a reduction of 100: 16, the diameter of the driving wheels in each case being 31½ in. In the first case the speed and pull curves are given for the full parallel position of the controller, in the second case speed and pull curves are given for the five running positions of the controller; with these two sets of curves a sample run has been worked out, as shown in the diagrams, in accordance with the following particulars:—Tractive resistance assumed to be constant, 20 lb. per ton; number of stops per mile, eight; average speed (including five-second stops), 10 miles per hour; maximum speed, about 16 miles per hour.

The energy consumption has been worked out, with the following results: With fields not shunted, 1·19 units per car-mile; with fields shunted, 0·96 unit per car-mile. In this particular case, therefore, the change of gearing and the different method of control make possible a saving of about 20 per cent. in the energy consumption.

This may possibly be regarded as an extreme case, but the matter may be put in another way. The energy imparted to the car between standstill and the time when it reaches a speed of 12 miles per hour is, in the one case, 82 watt-hours, and in the other case 68 watt-hours, so that on the assumption that this is repeated at regular intervals of 45 seconds, that is, 80 times per hour, the energy saved per car during one hour is 1·12 units. Thus, quite apart from the question of the energy absorbed by the brakes, which may vary according to the particular circumstances of the case, there is a clear saving of 10 per cent. of the energy consumption in imparting to the car a speed of 12 miles per hour.

The flexibility of the modified system of control by means of shunting the fields is clearly seen on reference to the remaining

figures. These two figures show speed-time curves for the two cases. In the first case, there are only two speed-time curves, namely, that in which the motors are in full series, and that in which the motors are in full parallel; in the second case there are

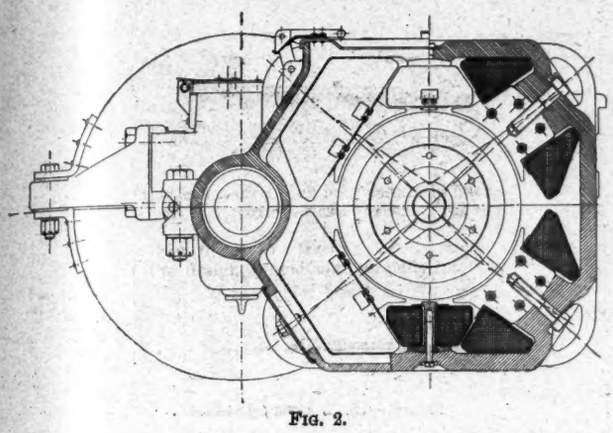


Fig. 2.

five speed curves corresponding to the five running positions of the controller. The comparison between the two sets of curves requires no explanation. The degrees of shunting assumed for the

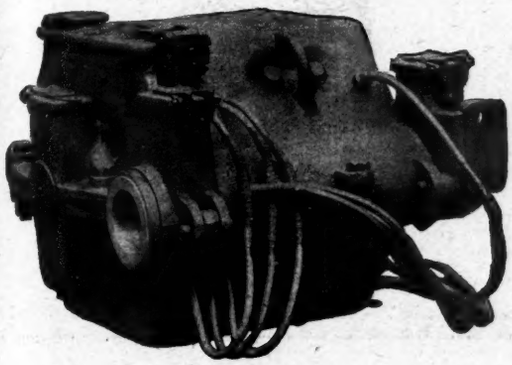


Fig. 3.

purpose of this calculation were not necessarily fixed, but may be modified to suit each particular case for which the equipments are desired.

Referring now to the construction of the motor, the general features of the design worked out especially for tramway motors

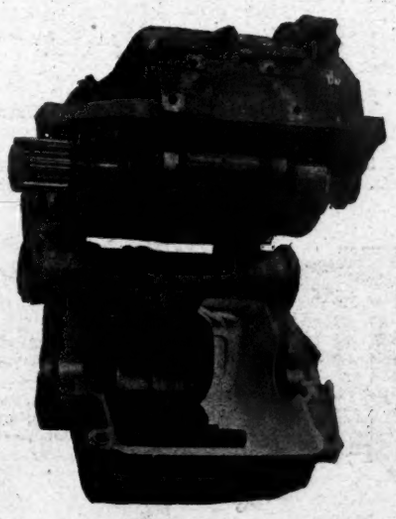


Fig. 4.

are shown in the general arrangement, fig. 2. In this figure it will be seen that there are the usual four main poles, and in addition two commutation poles, one between the main poles in the upper half of the motor and the other between the main poles in the lower half. In order to provide as much room as possible for these commutation poles and their windings, the main poles are given a special shape such that the magnet coils are not symmetrical about the centre lines of the poles, but are displaced sideways. The pole faces, however, are spaced symmetrically round the armature, so that there is no interference with the proper distribution of the magnetic flux. The main field coils and the commutation coils are specially wound to such a shape as to fit into one another, so that practically no extra space is required for the additional coils.

The general appearance of the motor will be seen from figs. 3 and 4, in which are shown the exterior and the interior of the motor.

Ten motors of this type for an output of 38 H.P. each have been supplied by Messrs. Siemens Bros. Dynamo Works to the Hull Corporation Tramways. A number of motors of larger output (50 H.P. type D 58 wa) have been supplied, or are now under construction, at their Stafford works for electric locomotives for the Harton Coal Co. in South Shields, for Brennan's experimental mono-rail car, and for the Adelaide Municipal Tramways Trust.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Kaleidoscopic Sign.

Messrs. Rashleigh Phipps & Co., of 147, Oxford Street, W., have brought out a new electric sign which presents some remarkable features. The sign consists of a disk about 3 ft. in diameter, and about 8 in. deep, the front of which is divided into cells after any desired pattern, one form being shown in the accompanying diagram, fig. 1. The cells are divided by opaque walls, which, as well as the back of the cells, are coloured in accordance with a symmetrical scheme, and in the middle of each cell there is a 5-c.p. lamp, set well back and not projecting beyond the front of the disk. There are 49 lamps in all, arranged in groups of four or eight, the odd one being in the centre; each group is controlled by a thermal flasher, the periods of extinction being

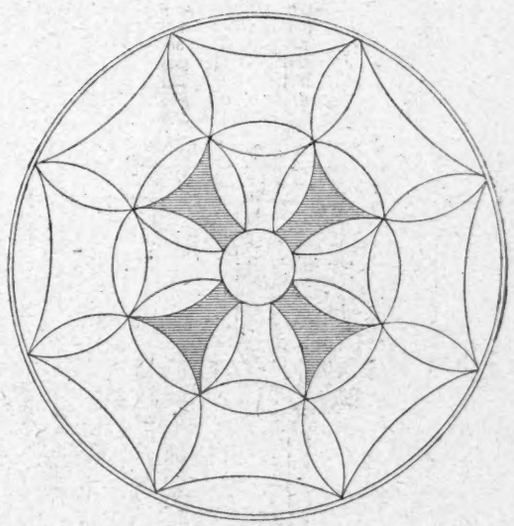


Fig. 1.—Kaleidoscopic Sign.

purposely varied so that the different groups are lighted in a perpetually changing order. The opaque walls of the cells ensure that any cell in which the lamp is extinct appears dead black; there are five different colours, including white, and these, with the black spaces, continually flashing up in different combinations, produce a fascinating succession of brilliant symmetrical patterns, some of which are strikingly effective. Very seldom, the whole of the lamps are alight at once, for a moment; at other times only a few are alight. It is difficult to give an adequate impression in words of the effects produced; as the makers say, it is really necessary to see the device in action, in order to realise its merits. We are informed that the device described has 1,015 different possible combinations, and though they are constantly changing, one rarely recognises one of them as having been seen before. The sign consumes only one unit in three hours, so that it cannot be called extravagant in energy consumption. Nothing could be better calculated to arrest the attention of the casual passer-by—and to hold it, for a considerable period.

D. & S. New Devices.

Contractors and users are always ready to welcome anything which tends to simplify and facilitate the work of wiring up. The new lines of iron-cased switches which are now being made by Messrs. Dorman & Smith, of Ordsal Electrical Works, Salford, and of which they have sent us particulars, have been specially designed with this object in view.

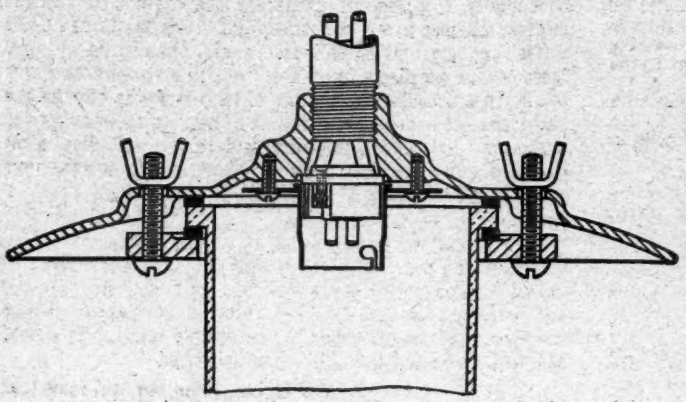


Fig. 2.—D. & S. Patent Well-Glass Fitting.

From fig. 3 it will be observed that a bevelled inlet, as shown, is employed instead of the ordinary method of bringing the pipes or cables immediately to the box itself. This inlet being easily detached from, or fixed to the switch-box, the wiring is facilitated, and the arrangement possesses the further important advantage that, in the event of its being necessary to remove the switch-box, this can be done without disturbing the pipes or wires.

The switches are specially applicable to alternating-current installations, where it is desirable for lead and return to be carried in the same pipe. Messrs. Dorman & Smith are supplying this new pattern in both their watertight and non-watertight iron-cased switches.

The same firm have also placed on the market a new patented type of strong iron well-glass fitting, which, as in the case of the switches, has been designed primarily with the object of facilitating the wiring-up of the fittings, and at the same time effecting some economy by reducing the number of parts.

Fig. 3.—D. & S. Switch-Box.

In these fittings the usual lampholder nipple is dispensed with, and the wires have consequently a straight run through from the tube into the lampholder insulator, eliminating dangerous bends in the insulated wires at this point, as shown above in fig. 2.

"Ajax" Ironclad Distribution Fuse Boxes.

Of recent years ironclad distribution fuse boxes have been almost universally adopted for power work, in place of the older forms of teak boxes, but the use of cast-iron cases for distribution fuse boxes has always been open to one great objection—extensions were a matter of serious difficulty and expense.

The Hope unit system, for which patent rights have been applied for, overcomes this difficulty entirely. It is being introduced by Messrs. Parmiter, Hope & Sugden, of Hulme Electrical Works, Manchester. In this system the cases are of cast-iron, built up in such a way as to allow of either end being removed, and an additional case unit being added, the box remaining perfectly watertight and gastight. One end of the case is a "male" and the other a "female," so that extra sections of case can be added at either end. Four strong set screws hold the cases, or end plates, as may be, together; additions can therefore be made in a moments. All the parts are "jig" made throughout, and extension pieces will go together without any filing or fitting whatever.

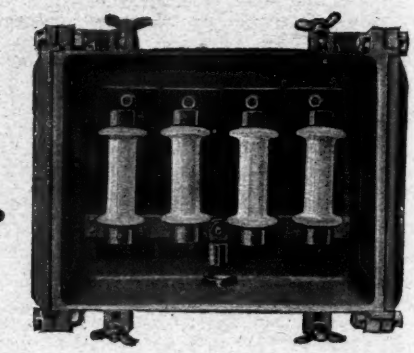


Fig. 4.—Hope Unit: Interior.

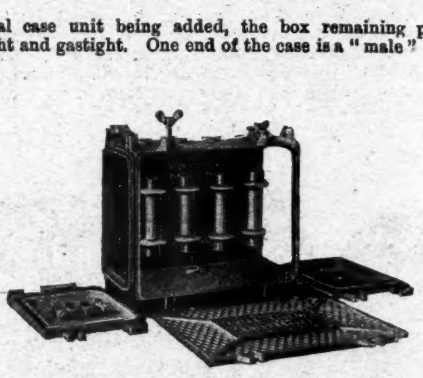


Fig. 5.—Box Dismantled.

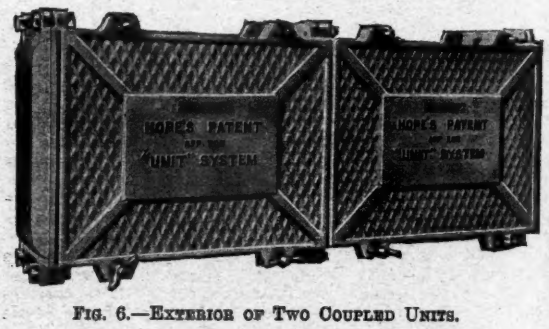


Fig. 6.—Exterior of Two Coupled Units.

Fig. 7.—Interior of Coupled Units.

With regard to the interior, each fuse-way is a separate unit complete in itself. The fixing of the bases and coupling-up of the

same to the bus-bars is done entirely from the front of the board, and extra fuse-ways can be coupled up whilst the board is "live," and from the front of the case.

All the bases are of black china, and the insulation test of any complete board is guaranteed to be at least 50 megohms.

Fig. 4 shows the interior of a single unit; fig. 5, the single unit dismantled, showing the method of construction; fig. 6 shows the doubled unit coupled up, with the lids closed; and fig. 7, the interior of the coupled units.

It will be noticed in fig. 7 that the board is a six-line board, with provision made for two extra ways to be added later, and that the drilling is ready complete, so that the extra ways can be added in a few minutes.

The "Timken" Patent Roller Bearing.

The Electric and Ordnance Accessories Co., Ltd., of Cheston Road, Aston, Birmingham, have taken up the manufacture of the "Timken" roller bearing, of which we give some particulars below. We are informed that this type of bearing has been very largely adopted by automobile builders in the United States, as well as for horse-drawn vehicles. There are, of course, innumerable other uses to which it can be applied; for instance, the bearings of electric motors, tramway and railway cars, &c. The three principal advantages claimed for the "Timken" bearings as compared with ball bearings are: the long bearing surface of the rollers, their ability to withstand end thrust as well as radial load, and their ease of adjustment, owing to the conical shape of the bearing, a unique feature.

The illustrations practically explain the construction of the bearing. It will be seen that the inner cone, which is fixed on the shaft, is provided with two ribs, an essential feature of the device. Round each roller there is a groove corresponding to one of these ribs, by means of which the rollers are confined to their track, and

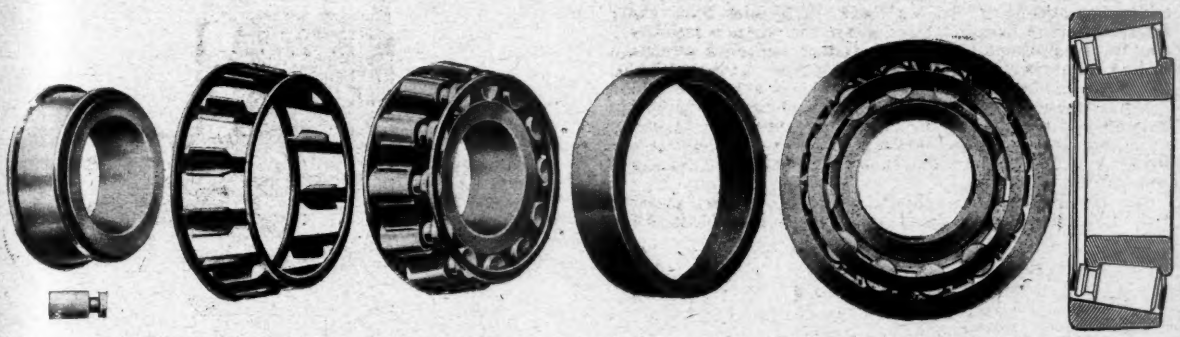


Fig. 8.—Details and Section of "Timken" Roller Bearing.

are prevented from twisting; but the bottom of the groove does not touch the rib, the load being carried entirely on the part of the roller between the ribs, on the cone. A cage pressed out of one piece of steel keeps the rollers in position on the cone. Lastly, the outer cup is tapered to fit the rollers, and by variation of its axial position with regard to the inner cone provides adjustment for wear—an important feature of the system. The whole thing is very simple and compact, occupying the same length as a ball bearing (from $1\frac{1}{32}$ to $1\frac{9}{16}$ in., according to size). The rollers are made of special nickel steel, hardened in oil, and, as well as the cups and cones, are accurately ground to size by machines.

The Electric and Ordnance Accessories Co., who own the sole manufacturing rights for Europe and the British Empire (except Canada), are commencing the manufacture of these bearings immediately in their works at Aston, where they have ample facilities for producing a large output.

NOTES ON TRADE ABROAD.

(*Continued from page* 479.)

British Success in Canada.

We are pleased to be able to record on another page in this issue the success which has attended the efforts of some British firms to secure important electrical and other plant contracts for the City of Winnipeg. Generators and exciters have been ordered from Messrs. Vickers, Sons & Maxim, Ltd., of Sheffield, while Messrs. Jens Orten-Böving & Co., of London, have carried off the water turbines. The latter firm, who are naturally very pleased with this important result of their Canadian skirmish, in a letter to us concerning the contract, allude to our own comments on hydro-electric possibilities abroad in the article on "Notes on Trade Abroad." They say:—

"You will now see that the remark of the 'visitor' to your office that there were no hydraulic specialists in England, has been given the lie. As you know, we have now got a large staff of Continental engineers in this office continually occupied in preparing the lay-out of hydro-electric schemes in all countries, and every day brings us in a fresh inquiry. It is, of course, a pity that we have to get most of our engineers from the Continent, but we are now taking in a considerable number of men from the universities and technical colleges, and training them up as water-power engineers. Of course, the process is slow, but when completed it will mean that there are English-born water-power specialists, which fact in the Colonies will doubtless have a great deal of weight.

"Of course, we always need help from the many water-power owning companies for tramways or electric light, the money for which has been almost entirely raised in England, and we hope soon that these and future companies will be fully aware of our existence, and we think you can do a good deal to help us and the allied manufacturers."

A Difficulty Regarding Canadian Business.

We announced in our last issue that the City of Toronto was inviting tenders for certain electrical and pumping plant, the tenders for which were to be lodged by October 14th.* In the American papers advertisements appear stating that the specifications and forms of tender can be obtained on application to the city engineer. From the date of our announcement of the news this leaves just upon four weeks wherein firms in this country are to submit their applications for these documents, prepare their tenders, and send them across to Canada. We do not say that this cannot be done, but the margin of time is very narrow, and the case is a fair illustration of the necessity for direct efficient and alert representation on the spot by men capable of taking the whole thing in hand and submitting prices, or cabling intelligently. It does not always happen that the contract remains open so long as we have mentioned—as an instance, let us look at another Canadian advertisement appearing in a leading New York technical paper for September 2nd. Here it appears that the Toronto City Electrical Department were open to receive tenders until noon on Tuesday, September 7th, for approximately 15 tons of bare copper conductors, or the equivalent in aluminium. This advertisement is, of course, drafted and published for local Canadian and American tenderers, and nobody in this country could expect to have a finger in the business in any case—whatever the nature of the contract—seeing that the American advertisement does not reach England until the list is closed. In another case it is mentioned that the City of Toronto "will shortly call for tenders for pole line supplies, including poles, cross-arms, pins, braces, &c. . . . For information apply Electrical Department, City Hall." Here there is no date given, but we venture to suggest that the advertisement is drawn up for everybody rather than the tenderer resident in England or Europe. We cannot expect our Canadian friends to hold back their work for a very long time purely in order to give their "family relations" in this country a chance of tendering. For many lines we must be actually on the spot to tender, if we are not there to

* Since these lines were written we have learned that the time for sending in tenders has been extended by a fortnight, to October 28th.

manufacture. We remember several years ago certain English municipal authorities in issuing their advertisements for electrical plant, &c., left so long for the preparation of tenders that it was generally regarded that they ardently desired the foreigner to have ample time in which to tender. Canadians are not in this position—they have electrical manufactories of all classes very near at hand, some on Canadian soil, some just over the border in the States, and they do not wish to wait for us unless for some special line. The point requires no further emphasising from us—we must be ready to tender promptly, whatever our price, if we are to succeed. Can we do this unless we are at the hub of Canadian electrical life? We must have our representative "right there."

"Are Electrical Engineers Wanted in Canada?"

We have had so many inquiries addressed to us regarding the prospects for electrical engineers in Canada that we are constrained to quote an opinion expressed by an esteemed engineer contributor who recently visited the country for the British Association meeting. We put to him the case of a young man of electrical training—now in search of employment—asking what were the prospects for him. His reply was that he stood a better chance there if he became a civil engineer entering at one of the Universities in Canada—say, McGill at Montreal—and emerging therefrom as a Canadian and an engineer, trained for aiding in the grand work of development that is awaiting the engineer. The Canadian Pacific Railway requires hundreds of young engineers every year, and all the "out-turn" of the Universities can be more than absorbed in their requirements alone. This is useful advice to young engineers and to parents or guardians who are seeking how best to place their sons or charges in fields less overcrowded than are most of the professions at home. But our contributor does not ignore that later there will be a good demand for electrical engineers, for their part in the great development must come when the foundations, so to speak, have been put in by the civil engineer. Already in the larger cities important electrical works are being contracted for, as we have shown above, and electrical engineers will be required for these, both in their construction and operation. If British firms can manage to secure contracts, they may also make openings for British engineers, but if American works are called upon, especially for hydro-electric work, then we guess men will come up from over the border.

Spain Again.

Why all this nervousness regarding Spain? We have said a good deal about its electrical possibilities in these columns, but we have yet more to say. Mr. British-Consul Maclean is pushing before us the claims of the Bilbao market, and he remarks :—

In the heavy electrical trades the tendency still is for orders to go elsewhere in preference to the United Kingdom, and this is probably due to the fact that foreign manufacturers were first in the field. But it is worth while to call attention to the fact that the use of electricity is constantly extending, and that the key to the Spanish electrical trades is cheapness.

Writing of machinery generally, he says that "competition in this market takes the form of cheapness and easy terms of payment, and consequently a lower class of manufactures than is generally made in the United Kingdom is introduced." Of course, risks that have to be run in conducting trading transactions with the markets of Spain and some other parts. Other manufacturing nations run these risks with far less nervousness than we do, and they get their "blow in fust." We are frequently told that British conservatism in declining to accommodate the foreigner in the matter of payments is losing us much business.

Relations with Russia.

We look for considerable benefit to British trade with Russia from the fraternising of the Russian and English peoples at the international exhibitions that are being arranged. In certain individual cases exhibiting may be too costly a matter, but these are only exceptions; the chances generally are of quite another kind, and in the sum total of British trade we are bound to gain from such events. We learn from the *Times* correspondent at St. Petersburg that in response to the invitation from the Russo-British Chamber of Commerce the representatives of the London, Liverpool and Manchester Chambers of Commerce will visit St. Petersburg on October 26th. Invitations will also be sent to Hull, Newcastle and Bristol.

The Tsar is taking a personal interest in the success of the Russian Exhibition to be held in London in 1911, the details of which were recently discussed between the St. Petersburg and London Chambers of Commerce. "The fundamental objects of the exhibition, which are to make the British public acquainted with Russian traders and products, will, it is hoped, be subsequently applied by the Chambers organising a British exhibition in St. Petersburg." We ourselves urged the adoption of the latter course in our issue of June 11th, 1909.

While alluding to Russian trade, we may remark that the *Anglo-Russian Gazette*, which has, so far, been running as a fortnightly, will, on October 1st, appear weekly. The September issue, which is before us, contains a good deal of matter, in both the English and Russian languages, regarding many points that require attention from those interesting themselves in Anglo-Russian commerce. There is one article that concerns us directly, as it relates to "Electrical Goods for Russia." Among other things, the writer says :—

In view of the keen competition in all branches of the electrical industry and the fact that the German firms have representatives and often depôts on the spot, the best means of introducing new business is to do as the German manufacturers have done, that is, to open a selling agency and later on a small depôt of those goods which are most in demand.

"At the head of this branch should be placed an engineer or a good salesman, equipped with the necessary technical knowledge, and knowing the commercial and financial customs of Russia, and speaking both Russian and, if possible, German well. Another suggested means of doing business is to undertake electric installations, especially of motors, on the credit system—that is, by accepting monthly payments. This applies chiefly to small factories and workshops.

In a leading article on "Why Germany is Beating England," we are informed that "the truth is that Germany has beaten us in Russia because while we have been indolently unenterprising, lulled into a dull lethargic commercial slumber, she has been alert, resourceful, pushful, vigilant, and as untiring in her efforts as she has been varied in her methods and her desires to please."

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Laundry Irons with Indicators.

In January this year new rules, regulating the installation of electric light and power in buildings, were issued and enforced throughout Australia, these rules being practically those of the Institution of Electrical Engineers, London, with certain additional rules adopted by the local authorities.

It may be of interest to you to know that electric laundry irons have to conform with the following rule :—" . . . in addition, every electric iron must have a lamp or other approved device so connected as to indicate at all times when current is on the iron."

We should be very interested to hear if there is any other part of the world where a similar rule is in force, and if so, what class of indicator is used.

We see several means of getting over the difficulty, but they all, more or less, possess disadvantages.

It has been suggested to put a low-resistance lamp in series with the iron, but this has its drawbacks, as, unless spares were kept by the consumer, his ironing operations would be liable to be suspended in the event of the lamp failing. Again, in this part of the world there is, naturally, not a very large demand for these low-resistance lamps, and consequently there might be a difficulty in obtaining them when they were required by consumers at short notice.

The placing of an ordinary incandescent lamp in parallel with the leads supplying the current to the iron is not viewed with much favour by the suppliers of power where there is a preferential rate for power as against lighting supply. It would be quite possible to have the lamp burning without the iron being in use.

Another alternative which occurs to us is to use some cheap form of galvanometer which would indicate when the current is on, but this would only be suitable in districts supplied with direct current. Neither would it appeal to us as being practicable, as it would be a very poor form of indicator, and one which would not be likely to catch the eye of the user of the iron.

Seeing that in Australia the only apparatus which is considered so dangerous—from a fire risk point of view—that it requires an indicating device is an electric iron, we are practically compelled to come to the conclusion that the indicating device will have to be part of the iron itself, as otherwise the consumer who has, say, half a dozen power plugs installed in his house, would have to have each plug supplied with an indicating device just on the off chance of his (at some future date) purchasing a laundry iron and plugging it direct on the mains.

Newton, McLaren, Ltd.
D. Eardley McLaren, *Managing Director.*

Adelaide, South Australia,
August 17*th*, 1909.

Testing Condensers for Leakages.

On returning from holidays my attention was called to two letters appearing in your journal referring to the above.

In reply to Mr. Middleton (August 16th), with a good reliable make of condenser, I hardly think it necessary to have continuous records taken. A slight leakage (unless running for some time) cannot have a very serious effect on the boiler range, so that an occasional test as described should suffice. As pointed out, what happens is that a small leakage tends to exaggerate the water consumption at the engine, should a test be going on at the time. Referring to Mr. Bayntun's letter (August 23rd), which reads much like an advertisement, a leakage that will gulp in sufficient salts to saturate the whole boiler range and bring about violent priming in half an hour, is a good sized gap, and will certainly not require a chemical test to locate it.

The use of silver nitrate as a test for chlorides in water is, indeed, a very old one, but I certainly thought the method of using it for detecting leaky condensers was new. However, perhaps he will oblige me by giving name and date of any paper containing a similar article.

Harbee.

September 14*th*, 1909.

[Mr. Bayntun described the silver-nitrate test in the course of an article on "The Working of Water-tube Boilers," contributed to the Electrical Review, October 12th, 1906.—Eds. E.R.]

"El Dorado."

Under the heading "El Dorado" you publish, in your issue of the 10th inst., a paragraph relating to an advertisement which appeared in the "Situations Vacant" columns of your August numbers. You give the number of applicants for particulars of this certain position, and the actual number of formal applicants.

I enclose for your perusal, and for publication, if you think fit, a list of duties, for which I sent.

Can one wonder, after reading over and carefully considering the requirements of the advertiser, that only one-half the recipients of this list should be sufficiently courageous to risk by applying for the post in question, being appointed the successful candidate?

Should these 50 per cent. be credited, or should honour be to the non-triers? To the latter I personally think. It is good to know that there is a remnant of self-respect held in the bosom of some of our engineers.

From the list of duties, I gather that the man appointed must accept responsibility for the entire undertaking, be his own charge-man, his own engineer, electrician, clerk and plumber. Truly, a most wonderful personage he must prove, with a constitution of iron, or overtaxed nature will rebel, or indeed a "man of gold," that he may have the wherewithal to provide sustenance against the fag of brain and body which otherwise the lengthy hours of toil and duty would surely occasion.

And look at the princely salary offered!

I apologise, Sir, for thus encroaching upon your valuable time, but really cases of this description do make one sympathise with "Omar," and wish him all luck in his prospective Canadian farming.

Non-Trier.

LLANDILO URBAN DISTRICT COUNCIL

Appointment of Electrical and Mechanical Engineer.

List of Duties.

The Llandilo electrical station is worked at present by a double set of D.C. generators driven by steam with battery of accumulators and battery booster.

The person appointed will be held responsible for the working of the complete installation and must take charge of the evening shift.

He will have to do all necessary extensions, alterations and repairs of generating plant, cables and storage battery.

A knowledge of lead-burning is essential.

To make new service connections, read, test and adjust meters.

Keep accounts of stores, &c., and present monthly reports to the Council.

The appointment is subject to three months' notice on either side.

Copies (not originals) of testimonials must be sent and will not be returned.

Applicants must be content with the above particulars.

Applications stating age, previous experience, and salary required, must be sent to me marked "Electricity Application," so that they may be received by me before August 31st inst.

By Order,
R. Shipley Lewis,
Clerk to the Council.

Llandilo, *August* **10***th*, **1909.**

Unemployment.

I am interested in "Omar's" letter; it is refreshing to meet a loyal man who will not take work at 25s. per week or so, though it is not every man who can afford to be independent.

It is the same old story, and we shall never do any good until we have a glorified trade union at the back of us like the medical profession, and the law, &c. I quite thought that, as a result of the various letters from myself and others in the early part of last year, we had succeeded in starting something in the way of a protective association, but I have reason to know the matter has dropped, so we are just as backward as ever.

I can sympathise with "Omar" as regards replying to advertisements, especially those over numbers, which I find are usually "no class"; they never have the courtesy to reply even when a stamped addressed envelope is enclosed. I think it would be a good thing if assistants would abstain from replying to numbers.

I notice in the current issue of the Review there are no fewer than seven advertisements for premium pupils, notwithstanding the overcrowded state of the business; this is one of the things which is killing our profession, and which should be taken in hand by a union.

Electricity Supply.

September 13*th*, 1909.

As an engineer with 12 years' experience with good firms, who has been seeking employment in this country for the last 12 months without success, might I ask if any of your readers could give me some information as to the prospects of finding work in Canada or other British Colonies at the present time?

Desperate.

The Enclosed Arc, or the Metal-Filament Lamp?

The article in your current issue by "Pam" gives some useful hints which should prove very acceptable to arc lamp manufacturers; therefore, it is rather a pity that certain of the author's statements seem to be somewhat misleading.

For instance, we are told that 3,000 to 4,000 M.H.C.P. for 500-watt flame lamps is ridiculous, yet, later in the article it is acknowledged that flame lamps give five times the

candle-power of enclosed lamps of similar current consumption; if, therefore, we select the author's example of a 600-C.P. enclosed lamp, and multiply by five, we arrive at one of the figures quoted as being ridiculous.

As a matter of fact, there is nothing to cavil at in such an estimation, and any responsible flame lamp makers will quote similar figures with actual photometer tests to back their claims.

One other point also calls for comment, namely, the comparison of costs between enclosed arc lamps and metal-filament lamps.

In both cases the energy consumption of one lamp only is given, but the depreciation is taken on four lamps, which does not give a fair comparison.

Harry J. Booker.

Manchester, *September 18th*, 1909.

The New Theory of Electricity.

You are hardly as courteous in your reply to my letter that you have been good enough to print in your current issue, as in that of last week. It is hardly courteous to misrepresent an opponent, and I presume I am an opponent in this case. It is not correct to say that I have heard of the investigations and experiments, for the first time. As I have before stated, I have followed the whole matter very closely. What I have not seen is an account of any experiment which justifies the claim which Sir Joseph Thomson made, and which I take it you endorsed. As you are aware, I am not the only doubter in this matter. The President of the Chemical Section of the British Association is apparently also a doubter, and I believe I am correct in saying that the new theory was never endorsed by Lord Kelvin to the extent of the claim made by Sir Joseph Thomson.

I presume I may also gather from the humorous letter signed "M. F. H. W.," which appears in your current issue, that he is also a doubter.

Sydney F. Walker.

Bath, *September 17th*, 1909.

P.S.—I should have thought that our many friendly bouts in past times would have told you that I only write when I have carefully studied my subject.

Automatic Transformer Switch.

Having read the letters *re* auto-transformer switches, I should be much obliged to "Engineer" for the name of maker of the switch he speaks of, which is sold for 32s. 6d. (subject), as I am about to fix three or four on an installation requiring same, and, having had no experience with these, would like one that is reliable, also without any appreciable drop; I might say that the full load of transformers are 2,000 watts and 1,250 watts. I have seen one working; it is very good from an electrical point, but its working is not always decided—*i.e.*, with a low C.P. lamp, say, 12 watts, it may go in or not.

I notice that "Student" says that transformers can be obtained with a no-load loss of 6 watts for 500 watts, but they don't seem to be usual marketable productions; 10 to 12 watts for the 500-watt size is about the average, and as much as 40 watts for 2 KW. These figures are actual tests from a number supplied, not from makers' lists.

I quite agree with "Climax" about the meter reading showing 10 per cent. higher on a small load, which equal the no-load loss, because from an actual test, not made by me, for three days, without any lights being used, the reading was not proportionate to the amount registered when the lights were used at full load. Hence the economy of switching off the transformer, or installing an auto switch if the former method is not convenient, which it was not in this case.

An Enquirer.

September 16th, 1909.

Electric Miners' Lamps.

Mr. Turquand's reply to my last letter dealing with the working costs of electric miners' lamps is evidently based not on personal experience, but on sources which may, or may not, be unimpeachable. I quite fail to see why anything so desirable as facts concerning the results of the Ediswan bulbs should be withheld; surely the cause of the electric lamp cannot be strengthened by such a policy.

The figures I have quoted are based on experience, the nature and extent of which are, I believe, familiar to Mr. Turquand. I am quite prepared to accept the assurance he has given that his lamp is a great advance on the Sussmann—so far as it goes—but, while I do not for one moment wish to put forward arguments calculated to assist the other "party," I cannot bring myself to accept unreservedly sweeping statements for or against the electric lamp unless some measure of practical proof is forthcoming. I do not agree with your correspondent's estimate of costs, which, I note, is the outcome of "further study" of the question. It has surprised me that he should have attempted to make any corrections on my statements before having thoroughly acquainted himself with the position.

I believe my experience with electric miners' lamps is the more extensive of the two; for this reason alone, I respectfully submit that my argument should be answered with figures. Meanwhile, I shall be glad to render any such help as may be at my command and likely to be of service to those interested in electric lamps.

Giraldus Jones.

Birmingham, *September 20th*, 1909.

Tramway Power Tariffs.

However much you may have qualified it, it cannot be denied that you deliberately compared the works costs of certain tramway power stations with the charges made by certain combined lighting and power stations for tramway energy, which charges are based on works costs plus capital charges. You then, in your explanatory notes, pick out certain items of the Glasgow tramways accounts which suit your purpose, because it would obviously not help you if you included *all* the items the Glasgow people themselves include.

A. H. Seabrook.

September 17th, 1909.

[Mr. Seabrook now says that we "deliberately" compared certain costs; last week he said we had "perpetrated a blunder." He is certainly nearer the mark now, for we knew perfectly well what we were doing, and no blunder was made. But we protest against his method of criticising a paragraph in our article, and refusing to recognise that it is inseparable from the remainder.—EDS. E.R.]

Before replying to your footnote to my letter, as published in the ELECTRICAL REVIEW of the 17th inst., I would like to say that my sole concern was, and still is, to (*a*) prove that your premises and conclusions as to Glasgow and Manchester were unsound, and (*b*) inferentially to show that probably your comparisons between other towns were also unsound. I have no wish to disparage the Glasgow Tramways Department in any way, nor to draw any comparisons further than are necessary, but your leader has put the advocates of combined undertakings on the defensive; and as one of them, I am merely wishful to prove that Manchester's traction policy has been a wise one.

May I further say, that I did not furnish the figures of cost for Manchester and Glasgow as absolutely, but only as approximately, comparable. My main object in giving the figures was to reveal the serious omissions in your survey, apparently with some result, for we now have a figure in the case of Glasgow of ·84d. per unit taking the place of the previous ·35d. I will, however, deal presently with the cost in greater detail, although there are serious difficulties in obtaining a really common basis of comparison. This difficulty of comparing like with like appears to have been entirely ignored by you, your assumption being that costs ought to be uniform, regardless of difference in financial policies, physical conditions, &c.

As an illustration of this, may I cite two cases—one town where, owing to halfpenny fares, many more passengers are carried than in the second town, the traffic being well spread out over the day, the other town enjoying the benefit of higher fares, but experiencing much worse "peaks" in the mornings and evenings. Leaving out of consideration the net results of the working of the two tramway systems, is it not obvious that the power costs in the first case are bound to be lower (reckoned per unit of energy consumed) than in the second? Then, again, as a more striking illustration, the cost of supplying energy in a widely scattered area cannot conceivably be as low as in a very compact and more densely populated area. All these differences undoubtedly influence costs.

But to return to the comparison of Glasgow and Manchester. It is true, as you say, that Glasgow's costs include £47,547 for depreciation, but you are in error in stating that there is no counterpart to this in the Manchester costs. Manchester provided £40,000 in respect of its entire capital outlay in the electricity department, and of this the tramways bore its proper quota. Glasgow's provision worked out at 4·58 per cent. on capital outlay as against Manchester's provision of 1·68 per cent., leaving a difference of 2 9 per cent. attributable to Glasgow's avowed policy of ultimately dispensing with borrowed capital.

On the score of provision for repayment of debt, Manchester had to provide 2¾ per cent. as against 2 per cent. in Glasgow—these percentages being, of course, beyond the control of either town; both towns, therefore, have to be put on an equality thereon for comparative purposes. On the score of rents, rates and taxes, the comparison between Glasgow and Manchester is anything but fair. Glasgow pays £48,000 against a total capital outlay of £3,145,576, but only debits power expenses (*vide* annual accounts, page 21) with £5,069, although the capital outlay on the supply of power (as distinct from operation of cars) is stated at £1,038,812. A proper allocation on the bare data published is not possible, but dividing the £48,000 in the ratio of the two outlays would give a further charge against the power costs of £10,053.

The Glasgow account as then put into line with Manchester (so far as circumstances permit) would read thus:—

Total costs as published	£136,145
Add amount under-estimated for rates, taxes, &c.	10,053
Difference in rates of sinking fund obligations	7,791
	£153,989
Deduct difference in rates of depreciation written off by the two undertakings	30,125
	£123,864

Dividing this by the figures admitted by you, viz., 25,204,530 units, less 496,770 units bought from the Glasgow electricity department, or 24,707,760 net, which allows for units "used in car works, depôts, &c.," we have a cost of 1·20d. per unit, as against Manchester's charge of 1·14d.

So far I have dealt with costs in the year 1908. If reference be made to the accounts for the year 1909, it will be found that in Glasgow there is a slight increase in costs, and that in Manchester the charge has fallen from 1·14d. to 1·04d. per unit. For the year now running the charge in Manchester is settled at 1d., plus or minus a slight adjustment in case coal differs from 10s. per ton.

It is thus patent that the tramways department in Manchester is buying current from the electricity department at a lower price than Glasgow's self-contained undertaking can produce it for.

As regards the linking of the two Glasgow departments, full advantage cannot obviously be taken until such time as renewals or extensions are necessary in one or both departments. The linking implies a decided change of policy, the whole fruit of which may not be apparent for some years.

G. L. Pearce.

[Mr. Pearce introduces certain questionable assumptions in order to support his case.

Thus he increases the Glasgow loan charges to a hypothetical amount in order to put them on the same basis as those of Manchester, but he makes no allowance for the overhead equipment, &c., cost included in Glasgow's capital expenditure, and not in Manchester's.

Then, again, he allocates three times as much rent, rates and taxes to the Glasgow power expenses as the Glasgow people themselves allow, but takes no account of the fact that the Scottish undertaking pays in rates, &c., 1·5 per cent. on its capital as against only ·92 per cent. in the case of Manchester; furthermore, he assumes the assessment at Glasgow to be *pro rata* on the capital employed in power plant and tramways, although the usual practice in tramway rating appears to be to assess the tramway undertaking on its gross receipts, while the power plant is allotted a proportion based on a small percentage of the structural value of buildings and plant.

If, as it appears, the power plant is favourably assessed as compared with the whole undertaking, and as compared with a combined plant, so much the better for the tramway power station.

Again, although Mr. Pearce makes an allowance for Glasgow's high rate of depreciation, he is significantly silent as to the proportion of the £40,000 provided at Manchester for depreciation, which may apply to tramway plant.

We have never suggested that exact comparison between the two cases was possible, but we do contend that something more than coincidence is required to explain away the lower power cost of tramway undertakings in general which possess their own plants, as compared with tramway undertakings in general purchasing energy, and particularly so in the case of undertakings in neighbouring towns.

For the rest, we quite appreciate Mr. Pearce's desire to prove that Manchester's traction policy is the correct one, although we may not agree with his method of doing so.—Eds. E.R.]

As Mr. S. L. Pearce's observations in your current issue respecting Sheffield's published figures on costs per units generated, may be open to an incorrect interpretation, may I be allowed to point out that the figure ·668d. was evidently taken from our statement of accounts to March 25th, 1908.

To bring these figures up to date, our total costs per unit generated for year ending March 25th, 1909, were ·659d., the allocation being taken from all items set out in what is now known, and happily agreed upon, as the "Standard Form of Tramway Accounts" (this having been considered suitable and applicable for comparative purposes to self-contained or other undertakings). The figure ·659d. is made up as follows:—

Works costs—including maintenance and repairs of all plant, ducts, cables, buildings, &c. ...	·390d.
Proportion of rates and taxes	·022d.
,, insurance premiums	·006d.
Interest and sinking fund	·241d.
	·659d.

I agree that our figures "require considerable adjustment" before they are comparable with those of Manchester," but it appears to me that Mr. Pearce, instead of bringing his figures down to our basis, raises our figures in his comparison up to ·81d. per unit, presumably from his own system of allocating certain charges.

As I am at the present time preparing a paper for the Institution of Electrical Engineers on "Equitable Charges for Tramway Supply," I must reserve my opinion as to what should be included under "fixed" charges in determining selling price to a tramways undertaking, which subject is a very debatable one.

H. E. Yerbury,
Chief Engineer.

Sheffield Corporation Tramways,
September 20th, 1909.

Induction Motor Trouble.

Could anyone, through the medium of this journal, enlighten me as to the explanation of the following tests on a 10-H.P. induction motor, slip-ring rotor:—Running light on 85 ~ 210 volts, it took 29 amperes 1,100 watts, whereas when stationary and rotor on open-circuit, it took only 15 amperes on 210 volts 85 ~. These readings give the following data: friction, windage and core losses, &c., = 1,100 watts;

therefore, at 210 volts, 5·25 amperes = energy amperes, and taking second reading as magnetising current, this = 15. Therefore, when running—

$$\text{resultant } C = \sqrt{15^2 + 5{\cdot}25^2} = 15{\cdot}9 \text{ amperes.}$$

This is totally different to test (1), which gave current = 29 amperes. Why is this? Are there any other losses to come in when running light?

Troubled.

REVIEWS.

Electricité Agricole. By A. Petit. Paris: J. B. Baillière et fils. Price 5 fr.

This is one of the 60 volumes forming the excellent agricultural encyclopedia edited by Mons. G. Wery, assistant director of the French National Agricultural Institute.

The book is well written, and is intended to show the French farmer what use has been made of electrical energy in farming operations, and to familiarise him with the terms commonly employed in electrical work. After explaining these terms, the book deals with the conditions under which electrical energy is generated and distributed. Direct-current dynamos and motors, accumulators, alternating-current machines and induction motors are described, and diagrams are given showing the various methods of winding motor and dynamo field circuits, as well as the connections of polyphase circuits.

The question of generation or purchase of electrical energy is discussed from the standpoints of convenience and economy, the various systems of charging are detailed, and the tariffs of a number of supply undertakings are given both for lighting and for power.

The rest of the book is devoted to a systematic study of the uses of electricity in farm work. The various methods of lighting are dealt with, and a number of electric lamps described.

Electrically driven ploughs, threshing machines, saws, pumps, root crushers, ice-making machines, cream separators and chaff cutters are each described, and the various methods of driving them are given, with—where possible—the power required.

Afterwards the use which may be made of electricity as a heating and ventilating agent is considered, and a further chapter deals with the cases in which the chemical effects of the electric current are made use of, as in the sterilisation of milk and of water by means of ozone, tanning, sugar refining, bleaching, and the rectification of alcohol compounds.

It is noticeable that no reference is made to the effect on the growth of crops which electrostatic charges are said to cause, or to the experiments which have been made under the direction of Sir Oliver Lodge on this subject.

The physical effects of electric currents are considered, and directions given as to the treatment to be applied in cases of electric shock.

The book contains much information as to actual installations, and in many cases gives capital outlay and working results. It refers to the difficulties which have had to be overcome in early installations, due to the antipathy of the workers to new methods. The author looks forward to a largely-extended use of electricity for farming purposes in the near future.

Kinlochleven Assessment.—An Appeal Court under the Lands Valuation Act was held at Oban last week, when the case of the Kinlochleven Water and Electric Power Co., which the assessor had assessed at £60,000, was considered. According to the *Glasgow Daily Herald*, evidence was led at considerable length by Messrs. Tait, Munro and Ferguson for the Aluminium Co., and for the assessor by Mr. Jackson, assessor of railways, and by Mr. Allan Carter, C.E., Edinburgh. After a hearing which lasted for five and a half hours, the Bench came to the decision that the works should be assessed at £30,000 when in full working order, being 5 per cent. on £642,000 of capital expenditure, and that for this year, owing to the incomplete state of the works, the valuation be restricted to £10,170.

BUILDING AN ENGINE FOUNDATION.

By ENGINEER-IN-CHARGE.

There is no structure embodied in the lay-out of a power house whose appearance appeals to the eye of an observer, or is likely to stimulate his imagination to inquiry when observed, less than the very basis of the most important and intricate machinery within the building, to wit, the engine foundation. As a rule, on the main floor of the engine room the foundation makes no appearance at all, and when on going below into the basement one does catch sight of it, it appears merely to be a wall erected for conveniently carrying racks for cables and conduits for lighting circuits, supporting the floor above it, and light duties of that kind, giving no superficial evidence of the heavy responsibility which is its *raison d'être*.

Nevertheless, in spite of its unpretentious appearance, there are many interesting details which must necessarily be considered and correctly summed up in order that the finished work may give satisfaction, and remain out of mind as well as out of sight during its existence. The notes which follow refer to the building of a typical concrete foundation, to carry a large high-speed engine and generator. Figs. 1 and 2 give a general idea of its shape and proportions; the superficial area was decided by the size of the plant to be installed on it, and the depth by the usual considerations of getting solid ground to carry the weight and of not transmitting any vibration to the walls of the building. In the example shown the base is slightly wider than the top; this "batter" helps to counteract the tendency for transmission of vibration, though it is not a necessity, many foundations for similar purposes having vertical sides and ends. The first step on the site of the new foundation is to mark out the plan, with its centre line duly set out from the adjacent machinery or other fixtures, as the occasion demands or allows. In the case under consideration a smaller generating set was removed and its brick foundation with it, in order to make room for the larger set, and then the ground was dug to the necessary shape to receive

Fig. 1.

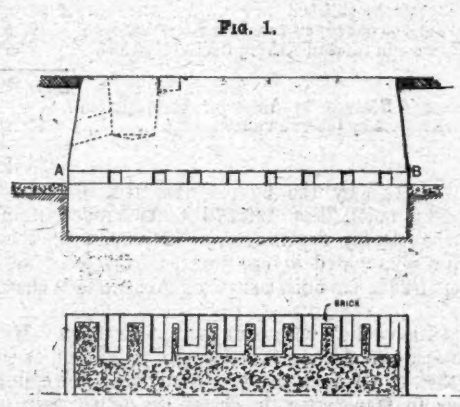


Fig. 2.

the lower part of the new foundation. In this process some water was encountered, but did not give much trouble, as it was only a small quantity of surface drainage, and by digging first one part and then another lower than the remainder of the space, the water could be drained away from the portion it was desired to work on. In order that the job should be done expeditiously, two shifts of eight men each were worked, 12 hours each, for four or five days, at the end of which time the space was ready for the new structure.

Whilst the work of clearing was proceeding, the adjacent machinery was protected from the dust, necessarily raised, by large sheets of tarpaulin hung as a screen between it and the work. Then the filling-in with concrete commenced, another process which was carried on continuously day and night, for the reason that if a layer of concrete were left exposed to the air some 10 or 12 hours, especially in such a warm atmosphere as is usual in an engine room, the surface would harden quite sufficiently to prevent its amalgamating

properly with the next layer put on above it, and the result would be, as has been shown by experience, that cracks would appear in lines marking the separate layers, and vibration troubles would set in. The concrete was prepared and handled as follows:—

A square wooden frame 5 ft. 6 in. × 5 ft. 6 in. × 11 in., holding approximately 1 cb. yd. of material, was placed on a level piece of ground, with bricks set in to make a good hard surface. The frame was nearly filled with good clean stone ballast, crushed to pass through a sieve of about 1½ in. mesh, and clean sharp sand, in the proportion of ten of the former to one of the latter, and on the top of the heap were deposited

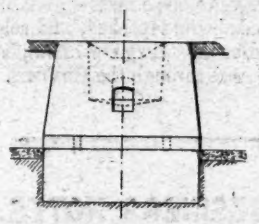


Fig. 3.

two and a half bags, 5 cwt., of Portland cement, making one cubic yard of material. The frame was then removed and the whole mass mixed, dry at first and then watered, the mixing being continued until the desired consistency was attained. The concrete was then loaded into a hand barrow and wheeled to the foundation site, where it was deposited by means of a long wooden shute leading down to the base of the foundation. The shute was moved about over the surface to be covered, and as the space was filled up, lengths were sawn off it as required. Layers of 8 or 9 in. in depth were spread over the whole area at one time. The ballast should be inspected for soft pieces of bad stone, which can easily be crushed in the fingers, and any with an appreciable quantity of such bad stuff should be rejected, or it would ruin the concrete. Similarly the sand is liable to be dirty, containing many pebbles and clayey lumps of sewage which appear black inside when broken; these also have a deleterious effect.

When the concrete was up to the lower floor level, it was carefully levelled off round the edges, and five courses of Staffordshire blue brick were laid in such a manner as to make openings from the sides for access to the nuts and plates of the bedplate holding-down bolts. (Fig. 3.)

The openings were then boarded up, three boards in each (fig. 4); on the top boards the positions of the bottom ends of the foundation bolts were marked, and circular wood

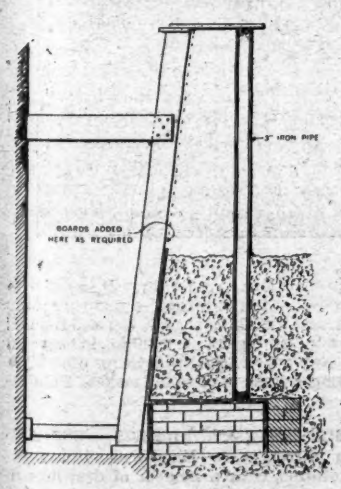


Fig. 4.

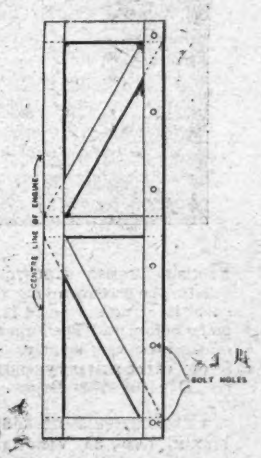


Fig. 5.

plugs, 3 in. in diameter, were nailed on accurately, with the aid of a large wood template frame (fig. 5). Above this level a frame was necessary to hold the concrete in the required shape until it had set; this was constructed by making a skeleton frame all round, of nearly vertical battens 10 ft. long × 7 in. × 3 in., spaced at intervals of about 3 ft. 6 in., sloping in towards the top to give the required batter (fig. 4). Each batten was propped by a board nailed to it at one end and bearing on walls or other fixtures at the other end; at the foot of each batten a prop was wedged, to hold it up against the strain which would tend to thrust it out when the interior was filled. Boards were then nailed horizontally against the battens, inside, and a layer of concrete filled in to a height of 8 or 9 in. The foundation bolt-holes were constructed by placing 3-ft. lengths of earthenware pipe, 4 in. in external diameter, centrally over the above-mentioned circular wood plugs, and concreting round. As soon as the concrete laid to the height of these pipes was able to retain its shape, the pipes were withdrawn and the process repeated for another length. Holes of 5 or 6 ft. length thus having been obtained, and the concrete-stiffened iron pipes, of 3 in. internal diameter, and of sufficient length to reach the final top level of the foundation, were placed in the holes, and some thin concrete run round them to fill the little annular space outside. Meanwhile, the bolt-hole template was fitted on to the tops of the iron pipes and each one supported *in situ* from the horizontal boards running round the top of the skeleton frame, by means of a board with a circular plug on it similar to the one at the bottom end of the pipe (fig. 4).

Then the process of filling up the frame with concrete was continued, boards being added horizontally as required to effect this. The boards at the ends of the frame were carefully sawn to shape the exact width of the foundation, allowing the longitudinal boards to project past their ends, and making a neat finish at the corners. At the generator end a pit was required to admit part of the machine and to allow for cleaning the same, inspecting cable connections, &c. To strengthen the walls round the pit, some two or three strips of expanded steel were laid, four square, enclosing the area of the pit, overlapping one another at the ends, with about 8 in. or 9 in. of concrete between the layers. The holes for carrying the cables from the generator to the basement, and for draining the pit in case of any liquid being spilt there, were made by laying iron pipes of suitable size in the required positions before the concrete was built up. The foundation top was finished off by a layer of special material 1½ in. thick, while the concrete was still wet, made up of two parts dross shingle (fine sharp slag refuse from iron furnaces, like flint) to one of sand and one of cement. This finishing layer was above the tops of the iron pipes and 2 in. below the floor level, which was made up by the flooring material after the machinery had been erected.

When the foundation was completed, a process taking about 18 days, day and night work without cessation, old sacks were spread over the top surface and nailed all round the timbering at the top, and kept damp by watering with a can every three or four hours for about ten days, in order to avoid any risk of the concrete cracking due to the outer portions drying and setting much more rapidly than the interior. Some nine days later the timbering was removed, and finally, rough places were filled in with concrete and smoothed off to make a neat job. The foundation was then ready to receive the machinery, so far as any work to be done was concerned, but such a large mass of concrete requires to stand about six weeks to two months at least before any great weight is put on it, and hence a very necessary consideration is to antedate this work by a considerable period to the delivery of the machinery. The weights of high-speed engines of the usual vertical enclosed type vary from about 14 tons for 250-B.H.P. size to 110 tons for 2,500 B.H.P., and though the turning moment of a well-balanced three-crank engine is very uniform, and gives rise to very little vibration, the dead weight is considerable and necessitates every precaution being taken to make the foundation firm, to avoid any risk of serious trouble after the plant has been put in commission.

South Africa.—The Customs Authorities of South Africa have recently given a decision to the effect that "electric magnetos and parts thereof imported separately" are to be classified under No. 986 of the tariff, the duty being 3 per cent. *ad valorem* on foreign goods, while those of British manufacture are admitted free of import duty.

USELESS TENDERING.

By "L. M."

It is surely high time that the electrical trade as a whole took up arms to put a determined stop to the present reckless waste of time and money in tendering for work which will never be given out, or for which some particular firm has been chosen, the invitation to tender being merely a cheap and easy way for the buyer to check the favoured firm's prices.

In many cases the amount spent by the various firms tendering must considerably exceed the profit to be obtained on the contract. Quite recently some 10 or 12 manufacturers were asked to tender for two or three small (20-H.P. and under) motors to special requirements, where they could not possibly hope to secure the order, seeing that the purchasers have a financial interest in certain electrical works. An invitation to tender should certainly imply that the client intends to make fair use of the tender, *i.e.*, to buy from the party tendering if he sends in a favourable offer; and any departure from this course is nothing more or less than "obtaining prices and technical data under false pretences." In how many instances, after one has gone to a lot of trouble and expense to quote, does the client absolutely refuse to give any explanation as to why the order has been placed elsewhere! In fact, the treatment of contractors' representatives is in many instances little short of scandalous.

The consulting engineer has had many hard things said against him, such as making up his final specification from the contracting firm's tenders by the "scissors and paste method," and obtaining trade discounts for clients not connected with the trade; there is, however, a far more objectionable element—namely, the non-manufacturing contracting firm that usually poses as specialising in some particular branch such as power distribution or mining, ships' plant, &c.

Many of these firms are agents (openly or otherwise) for manufacturing firms, mostly Continental, on the one hand; while they are controlled and even actively managed by gentlemen who are at the same time managers or on the boards of directors of the firms purchasing plant. Now as these good people are naturally interested in the welfare of the agent firm, they must naturally be inclined to give their tenders undue preference, even to the extent of thereby going against the best interests of the company purchasing the plant, for no man can faithfully serve two masters.

Outside firms have little or no chance, as if they quote favourably the agent firm naturally knows their exact prices and simply modifies its tender to suit the case.

It is almost impossible for the electrical trade to stop this sort of thing, and the only course would appear to be the publishing of a sort of black list, so that the trade would know when owing to vested interests it would be useless to quote. It should, of course, be quite illegal for a director of any company at the same time to be on the board of, or connected with, a second company doing business with the first; but the present state of our company promotion law is a national disgrace. At present, A, B and C float a company; A's firm supply the building material, B's the electrical plant, and C's the engines and boilers; then they calmly make their exit, and leave the poor shareholders proper with the white elephant. As a well-known legal gentleman once said, "Don't steal a horse, or you will be put in prison for theft; buy it, but don't pay for it, and with reasonable care you will be quite safe."

Possibly when our foreign rivals have captured still more of our trade (they are certainly doing remarkably well at the moment in South Africa) we shall wake up and get a *business Government* and a set of *business, company and other laws*; meanwhile the only hope seems to lie in more united working together, and less "cut-throat" policy among the trade itself.

Abroad the various firms work together far more than we do, and, partly as a result, manage to pay decent dividends, whereas few electrical firms in this country are paying anything worth speaking about.

Almost without exception, the whole of the foreign agents are dealing in this country under Anglicised names, so that buyers dealing with these firms are often under the impression that they are getting British-made goods; this is very noticeable in the cable trade, and especially in the name-plate business.

A contractor in the Midlands, recently tendering for "British-made material throughout," offered cables made by a firm having a London address, believing this to be a British concern, whereas it is merely the English branch of one of the German cable works.

In this respect the Merchandise Marks Act is defective, as so long as no name or trade mark appears on the goods, it is not necessary to mark the goods as "made abroad." The cases, of course, have to be so marked, but there is nothing to prevent the goods being repacked, and sold, more or less, on the understanding that they are of English manufacture, after they have passed through the Customs.

BUSINESS NOTES.

B.T.-H. Lamp Poster.—We do not remember any line of electrical manufactures in which the British designer has evidenced so much ingenuity in the production of original and striking publicity cards as he has displayed in pushing the sale of metal-filament lamps. A number of these have already been alluded to in the Electrical Review, and we have now before us one, more humorous than some others affect to be, issued by the

B.T.H TUNGSTEN LAMPS
SAVE
70 % IN CURRENT CONSUMPTION
COMPARED WITH CARBON LAMPS
WHAT ARE THESE, Mr GARDENER ?
B.T.H. TUNGSTEN. THEY ARE THE BEST BULBS.

British Thomson-Houston Co., Ltd., of Rugby. It is easier to publish the accompanying block of the card than to write anything about it. The show-card is supplied in two sizes, the smaller one being before us. The larger, measuring 20 in. × 30 in., is expected off the press very shortly. Any dealer in B.T.-H. lamps can obtain a copy of the poster by sending a trade card to the makers' Publication Department at Rugby.

Catalogues and Lists.—Messrs. Vickers, Sons and Maxim, Ltd., 32, Victoria Street, S.W.—Eight-page illustrated pamphlet containing a description, with a number of drawings in colour, of the V.S.M. automatic forced lubrication system as made by them for all types of bearings, including axle boxes for rolling stock. Notes of advantages, and a list of prices of rigid pedestal bearings, and swivel bearings and component parts, are given.

Messrs. Baxendale & Co., Miller Street, Manchester.—Very complete illustrated catalogue of 76 pages, covering a large variety of electric bells and kindred manufactures. Prices are set out plainly, illustrations are profuse, and diagrams of connections are given. The articles included in the list are pushes in wood, china and metal—plain and ornamental—door contacts, burglar alarms, numerous electric bells for house, factory, outdoor, mining and

other service, indicators, bell wires, overhead line material, batteries, complete bell sets, induction coils, magneto medical apparatus, lightning conductors, and very many other things.

Messrs. Dorman & Smith, Ordsal Electrical Works, Salford, Manchester.—Illustrated and priced leaflet of D. and S. 600-volt "C" type main switches and a new series of cast-iron mill fittings.

Messrs. Smithson, Sharpe & Co., Sykes Street, Hulme, Manchester.—Sixteen-page illustrated price list of "Manchester" arc lamps and accessories. It shows and describes briefly vertical and inverted differential arc lamps, vertical single enclosure, twin carbon, photographic printing, and miniature arc lamps, also a number of devices such as "live" resistances, transformers, choking coils, elevators, weather-proof hoods, &c.

Messrs. Ross & Co., 62, Robertson Street, Glasgow.—This is a bulky catalogue of 120 pages which is described as a "Wholesale and Export Price List of wires, cables and electrical accessories." Commencing in Section A with "Rosa" vulcanised electric light wires and cables and flexible cords, also bell, telephone and other wires, it proceeds to particularise in Section B, a large variety of of electric lighting accessories such as fuseboards and main switches, insulating material and tools, arc and incandescent lamps, dynamo brushes, ironclad switches and fuses, wall plugs, tumbler switches, ceiling roses and other things of that cult, with some wood blocks and shades, and factory and ships' fittings bringing up to the rear. The largest section of all ("C") is devoted entirely to electric bells and accessories, covering a host of materials used in that connection.

The Linolite Co., 25, Victoria Street, S.W.—Several new publications regarding the "Tubolite" system. One expatiates upon the efficiency and economy of the system using metal-filament lamps; another gives technical particulars of the system of both metal and carbon lamps and candle-power life curves; a third shows the system for shop window and stage lighting, and for desk use; another is a price list, while, lastly, a leaflet describes the "Challenge" patent door alarm.

Messrs. Atkinson Bros., Aire Place, Kirkstall Road, Leeds.—Several lists of their manufactures giving particulars with illustrations and prices ofthe following:—Electric box-blade fans, punkah fans, and motor-driven ceiling fans; three-speed sensitive electric drills, motors and polishing machines fitted with the firm's dust-proof bearings, hand-power bench screwing machines, motor-driven hack saws and factory ceiling fans, all of which are manufactured at the above address.

The Foster Arc Lamp and Engineering Co., Ltd., Worple Road, Wimbledon, S.W.—Two leaflets relating to the "Foster" automatic transformer switch, giving prices and instructions for working and connecting same, and to the electric bell transformers for use on A.C. supply.

Messrs. Litholite, Ltd., 55, Hackney Grove, N.E.—Sheets 16 and 17 (for insertion in their catalogue) giving illustrations and dimension sketches of their standard Litholite insulators—tube-end bushes, electrolier nipples, wall plugs, also formers and bobbins, and insulated spanners.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—20-page pamphlet (No. 21A) giving full descriptive particulars with dimensional sketches, and a good deal of tabulated technical data as to sizes, speeds, efficiencies, &c., of Peebles continuous-current dynamos and motors of medium size, self-contained—of the protected, semi-enclosed and totally enclosed types respectively. It is hoped that the fully approximate dimensions given of all machines listed will be useful to customers in determining the space necessary for any machine.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—A novelty which has been issued to continue the popularising of the "Efesca" metal-filament lamp with the private consumer, takes the form of a pasteboard cut-out reproducing the actual lamp. Upon opening out the two halves of the bulb one finds pasted within a folded circular telling about that 70 per cent. saving in current consumption and other interesting matters relating to the lamp. The firm will supply a batch of these novelties, with his own name and address printed thereon, to any trade customer interested.

Messrs. Druce & Co., 72, Temple Street, Wolverhampton.—Loose leaflet giving particulars and prices of overload circuit-breakers.

Messrs. Wm. Wadsworth & Sons, School Hill, Bolton.—"Something New in Transporting" is the title of a very attractively-produced folder with an impressive cover quite out of the ordinary style, informing the recipient that the firm is "At your service!" for any of the electric passenger lifts, goods lifts, electric transporters and other specialities, which are alluded to in the few pages of illustrations that are within.

Messrs. Elliott Bros., 36, Leicester Square, W.C.—Leaflet describing the Campbell-Hyslop Map and Fuse Scale, for the use of officers in field artillery training.

Messrs. Hawksley, Wild & Co., Ltd., Brightside Boiler Works, Sheffield.—Leaflet relating to the "Suckling" water-tube boilers, in which the tubes are vertical between two large drums, with ample provision for free circulation and facilities for removing any tube without disturbing others.

Photographic Exhibition.—The annual exhibition of the Royal Photographic Society of Great Britain is now open at the New Gallery, Regent Street, and includes a number of radiograms, and other examples of scientific photography.

Bankruptcy.—*Re* Joseph Richard Hill, The White House, Wollaston, Worcester, carrying on business at the Orb Works, Lye, Worcester, inventor, &c.—The first meeting of creditors was held at Dudley on September 21st, when a statement of affairs was submitted showing liabilities £1,037, f which £702 was expected to rank. There was a deficiency of £531. The causes of failure as alleged by the debtor, were chiefly heavy expenses in connection with experimenting and developing patents. The debtor, who is 58 years of age, patented a reduction gear for electric motors in August, 1904. Early in the following year he purchased the Orb Works, Lye, for £300, after paying which he had about £200 capital. He took these works to develop his inventions, which were chiefly in regard to electrical machinery, and to carry on business as a scrap iron merchant. In November, 1906, debtor sold a fourth share of his patent for reduction gear for electric motors for £250, but he had not been successful in selling the remainder, and it figured as an asset, but he could not estimate its value. The receiving order was made on August 30th on a creditor's petition, the act of bankruptcy alleged being that the debtor had made an assignment of his property to a trustee for the benefit of his creditors generally. The debtor has not yet been adjudicated a bankrupt, as he thinks possibly that his friends will assist him in offering a composition. The bank holds the deeds of the Orb Works as a security for an overdraft. In April, 1908, debtor purported to mortgage the whole of his household furniture for £200, then advanced, but as the document was not registered as a bill of sale it is of no value. At the meeting on September 21st, the question of a composition was considered, but the debtor said he was not prepared to make a definite offer. The matter was left in the hands of the Official Receiver.

E. F. Jones, plumber and electrical engineer, York Road, West Hartlepool.—Order made at Sunderland, September 16th.

H. P. Alison, 7, Great Newport Street, London (Laing, Wharton and Cunnington).—This bankrupt has applied for his discharge, and the application is to be heard on October 13th.

Herbert John Burdett, electrical engineer and contractor, 16, Regent Street, Rugby, and 32, Earl Street, Coventry.—The Official Receiver has issued a summary of the debtor's statement of affairs. —This shows gross liabilities amounting to £1,214, of which £1,154 is expected to rank. The assets, after deducting preferential claims, are estimated to produce £334, leaving a deficiency of £819. Debtor gives as the causes of failure, "trade depression in Rugby, competition, bad debts, illness and heavy rental." The first meeting of creditors was held on Monday at the offices of the Official Receiver (Mr. C. J. Band), Coventry. Mr. H. L. Reddish appeared on behalf of the debtor, and the proceedings were only formal. Mr. Alfred Cripwell (Messrs. Corfield & Cripwell) was appointed trustee.

Book Notices.—Manchester Steam Users' Association; Memorandum by Chief Engineer for 1908. Manchester: The Association.—It is well known that Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, during the past few years has devoted much attention to the study of water-hammer in steam pipes, and has practically made the subject his own; the present memorandum is entirely devoted to comparing actual cases with the theory of water-hammer which he has put forward. He finds that nearly one-half of the number of explosions are due either to the absence of drain cocks on steam pipes, or to their injudicious use. A large number of explosions, chiefly on steamers, are caused by admitting steam into pipes which contain water; other explosions have occurred when water was admitted into steam pipes, or when steam condensed in them. There are also cases of steam being admitted through valves on which water was resting, the injudicious opening of valves having steam and water on both sides, and injudicious manipulations of steam valves whereby plugs of water were set in motion. Mr. Stromeyer points out that as the fitting of draining arrangements, which are intended to obviate explosions, has been the cause of the majority of explosions, and because in complicated pipe arrangements the water-hammers which do occur may often be attributed to any one of the possibilities mentioned above, it would be dangerous at present to lay down definite rules for the design of pipe arrangements in general. He hopes, however, that his present memorandum will enable those who have to deal with steam pipes to do so in the light of the accumulated experiences of the past, which he has now carefully classified. Mr. Stromeyer complains of the deficiencies in the official reports of steam pipe explosions, and more particularly of the judicial pronouncements of the Official Courts of inquiry; instead of explaining the physical causes of the explosions, the finding of the Courts is generally devoted to matters of personal responsibility.

"Proceedings of the Incorporated Municipal Electrical Association, 1909." London: Wyman & Sons, Ltd. Price 5s.

"Chats on Electricity." By Frank Broadbent, M.I.E.E. London: T. Werner Laurie. 1909. Price 3s. 6d. net

"Experimental Physics and Mechanics." By J. L. Maxim. London: Longmans, Green & Co. 1909. Price 1s. 6d.

Important Canadian Contract.—As announced in our "Contracts Closed," Messrs. Jens Orten-Böving & Co., of London, have secured the order for the water turbines which the City of Winnipeg are about to install. The contract is to deliver five turbines of 5,300 H.P. and two of 450 H.P., the total value being $97,150, and we understand that the turbines are the largest of their type in the world. They are of the Francis type, and a considerable amount of the work will be done in this country, though the main hydraulic part will be delivered from Sweden. Unfortunately for this country, as we understand, the manufacture of Francis turbines requires a very long experience, otherwise these large turbines would have been turned out in Great Britian. The question of impulse wheels is quite a different matter, since the execution of work to drawings is comparatively simple in their case, and Messrs. Willans & Robinson, who are manufacturing impulse wheels to the designs of Messrs. Böving & Co., will shortly have several very large wheels under construction. That this

order, however, has been obtained by an English firm in competition with all the world, shows what can be expected in the future in connection with the many hydro-electric developments that are going on, and opens up a promising vista for such firms as Messrs. Willans & Robinson, who have recently taken up the manufacture of water turbine machinery, and to hydraulic specialists such as Messrs. Boving & Co.

The "Wultun" Metal-Filament Lamp.—The business of the Premier Electric Lamp Co., Ltd., of Huyton Quarry, near Liverpool, has been absorbed by the British Tungsten Lamp Co., Ltd., who will continue the manufacture of all lamps previously made, and also metal-filaments of the highest quality, at the works at Huyton Quarry. For some months past the company has been engaged in the equipment of the factory with machinery and plant of the latest pattern. The "Wultun" lamp is manufactured solely by the firm under a patented process, and it is claimed to be the most durable and reliable, and that it will burn in any position, does not blacken, and has an average life of 1,000 hours. The "Wultun" lamp is manufactured throughout by British labour at the works, Huyton Quarry. Every lamp is thoroughly tested before leaving the factory.

Dissolutions and Liquidations.—Messrs. Wright Bros. & Co., electrical engineers, 6, Queen's Elm Parade, Chelsea. —Messrs. J. Hemingway, C. Wright and H. T. Wright have dissolved partnership. The Messrs. Wright will attend to debts, &c.

Thomas R. Martin & Co., Ltd., Pilgrim Street, Newcastle-on-Tyne.—A first and final dividend of 6d. in the £ is being paid.

Wireless Control Syndicate, Ltd.—This company is winding up voluntarily, with Mr. Ernest Mason, 6, Gracechurch Street, E.C., as liquidator. A meeting of creditors is to be held on September 30th at 14, Gracechurch Street, E.C.

The Japan-British Exhibition.—We have received a copy of the preliminary prospectus of this Exhibition which is to be held from May to October next year at Shepherd's Bush. The Japanese Parliament has already voted 1,800,000 yen (£180,000), and the Government of Formosa and the Local Prefectures have also voted large sums for the Exhibition. It is hoped that the Exhibition will afford Great Britain exceptional opportunities for the maintenance of her position in the foreign trade of Japan. As many of the leading merchants of Japan, as well as business men from other countries, are expected to visit the Exhibition, it is thought that the display at Shepherd's Bush should serve as a powerful advertisement of British products and manufactures. Application forms with schedules of prices for exhibits can be obtained from the Secretary, Japan-British Exhibition, 1910, Exhibition Offices, Great White City, Shepherd's Bush, W.

Time Recorders.—The International Time Recording Co. have just received a repeat order for 12 automatic two-colour time recorders from Messrs. Marshall, Son & Co., Ltd., Gainsborough, also further orders from the Municipal Council of Shanghai, Imperial Japanese Navy and the Woolwich Arsenal.

Trade Announcements.—The Electrical Apparatus Co., Ltd., of Battersea, notify that in future they will be the only manufacturers of the "Koolark" enclosed fuse, and all inquiries and orders for same should be addressed to them, no other firm being authorised to sell or deal in this fuse unless they purchase same from this company in the first instance.

Mr. G. Braulik informs us that Mr. C. Hook, who was engaged in the sales department in his business for a number of years, and also Mr. G. W. Pointer, have severed their connection with the business, owing to a reorganisation of the staff.

Welsbach Metallic-Filament Lamps.—An interesting announcement has been made this week, to the effect that the Welsbach Incandescent Gas Light Co., Ltd., have decided to add the supply of metallic-filament electric lamps to their large trade in gas mantles, &c. For the present the lamps will be imported from Germany. The following extract from the official announcement is noteworthy: "As a business move there can be no question of the soundness of the Welsbach policy; because, whilst there is not, and cannot be, any suggestion that electricity is as yet anything like so cheap as incandescent gas, still the Welsbach is a business company, and there are factors other than cheapness to be taken into consideration, notably the greater cleanliness of electric light." Loyalty to their leading line naturally imposes a certain restraint upon the company's enthusiasm for electricity, but it is easy to read between the lines, and we congratulate the company on their shrewd insight into the future of electric lighting.

LIGHTING and POWER NOTES.

Braunton.—The P.C. has decided to have an interview with Messrs. Crompton & Co.'s engineer with reference to public lighting by electricity. The company offers to provide about 40 lamps, and the cost would be £50 a year, which is slightly less than the cost of the present oil lamps.

Brighton.—In consequence of a report by Mr. Christie on the unsatisfactory condition of the lock gates at Shoreham Harbour, which might result in serious consequences to the working of the electricity station, the Harbour Trustees have decided to refer the matter for consideration by the Works Committee.

Brumby and Frodingham.—The U.D.C. has decided to light the town by electricity in place of the present oil lamps. Energy will be supplied by the Frodingham Steel Co., and the annual cost will effect a saving of £60, whilst a much superior light will be obtained. The capital cost will be £300. The question of obtaining a prov. order so that electricity will be available for private lighting has been deferred for a year.

Bury St. Edmunds.—The T.C. has decided to have the Town Hall and offices wired for electric lighting, the work to be carried out by the electrical engineer, who is to engage a wireman. A motion in favour of the work being carried out by the electricians trading in the town was rejected.

Canada.—The amount of electricity developed in Canada during the past year amounted to 494,358,966 kw.-hours. Of this large amount, 359,280,286 units were exported and 135,075,680 consumed in Canada. The exports were, of course, largely from Nisgara Falls production.

The Canadian Light and Power Co., of Montreal, has contracted with J. G. White & Co., New York, for the construction of a hydro-electric plant on the St. Lawrence River, near St. Timothee, Quebec. The plant will utilise the Beauharnois Canal water, giving an available and constant head of 50 ft. The power station will contain three 7,200-h.p. turbine units coupled to 4,000-kw. generators and have space for a fourth unit; also two 400-h.p. exciter units and switchgear; the 27-mile transmission line to Montreal, and sub-station and distributing system at that city, will also be included in the contract, which is estimated to cost about $4,000,000.

Carlisle.—The E.L. Committee has decided to ask the Council to agree to a reserve fund being formed, towards which £600 will be contributed.

Chippenham.—The Electric Supply Co. has commenced the laying of cables in the town.

Continental Notes.—Holland.—It is announced that the municipal authorities of Dordrecht have voted a sum of £600,000 for the establishment of a large central electric lighting station in the town.

Switzerland.—It is proposed to construct an electric mountain railway over the Pillon Pass, between Lepey and Gstaad, as a branch of the Montreux-Zweisimmen line.

Dundee.—The damage by the recent fire at the Corporations station has been assessed at £1,588, and the insurance company has paid the claim. This sum excludes the damage to 23 small transformers belonging to the B.T.-H. Co., which were in the building, and were scorched by the fire. The Corporation has accepted an offer of £550 from Wm. Kerr & Co., Glasgow, for four boilers and two generating sets which were also damaged.

Messrs. G. & A. D. Grimond, Ltd., jute manufacturers, have intimated a claim for £2,582 against the Corporation for failure to supply electrical current according to agreement. The firm bases its claim for damages on the ground of loss of production, disorganisation of plant, &c. The Electrical Committee decided to repudiate all liability, it being stated that Messrs. Grimond were not prepared to receive the supply on the date specified. A Committee has been appointed to watch matters in the interests of the town.

An automatically controlled system of stair lighting has been introduced in a tenement in Seymour Street, which it is hoped may help to solve the vexed question of stair lighting. The Dundee police are to be provided with electric lamps in place of the usual oil lamps.

London.—Hammersmith.—The town clerk has been instructed to make formal application on behalf of the Council to the Board of Trade to appoint a Referee under Sec. 33 of the Tramways Act, 1870, to determine the difference with the London United Tramways, Ltd., in regard to the tracks.

Bermondsey.—The Electricity Committee report having had under consideration a letter from the L.C.C. as to the reserve and renewal funds in respect of wasting assets, where loans had been advanced for 42 years. The Committee points out that the Bermondsey B.C. has recognised the need of a reserve fund, and there is one in existence at the present time with an amount to credit on March 31st of £3,807, and after the current financial year it is intended to add to the fund until a limit is reached of 10 per cent. on the capital outlay.

Merthyr Tydfil.—The Traction and Lighting Co. has applied to the B. of T. for consent to the use of overhead lines for the supply of electricity to Pontmorlais Road West.

Mexborough.—The U.D.C. has received from the L.G.B. sanction to a loan of £3,986 for E.L. purposes. The Council had applied for £4,700, and the sum deducted included £271 for costs of the prov. order. The Council has decided to ask for an explanation of this deduction.

Ramsbottom.—The U.D.C. has approved of the deed of transfer of the E.L. order to the Lancashire Electric Power Co.

Salford.—On Tuesday, Mr. Hooper, of the L.G.B., held an inquiry into an application by the Corporation for sanction to borrow £9,500 for the purpose of electricity undertakings in the borough, including a Prestwich scheme. It was explained that £3,000 was required for the Prestwich undertaking. Three previous loans had totalled to £8,600. Mr. L. C. Evans, the town clerk, explained that great progress had been made in the district, and there were now 205 consumers against 12 in 1905. There was about £1,500 unexpended on the previous loans. The application to borrow £6,500 for a battery installation and other improvements at the generating station in Frederick Road was then dealt with, and Mr. Billington, chairman of the Electricity Committee, said that it would have been better for the undertaking if the profit, had been utilised for the provision of better plant instead of bein devoted to the relief of the rates. Mr. Hunt and Mr. Hamps-

protested against money being taken from the profits for the relief of the rates when the undertaking was not on a sound footing. They were looking to the future rather than to the present. The town clerk contended that the Council were acting on business lines, and that the undertaking was financially sound. The inquiry was shortly afterwards closed.

South Africa.—The report of the Johannesburg T.C. for the year ended June 30th and the estimate of expenditure for the new municipal year have just been published, and will be of interest to our readers. The revenue from the gas and electricity supply has been £51,900 and from tramways £21,300. The working costs have been reduced from 1·07d. to ·677d. per unit, and is accounted for largely by the fact that for the first time the Council has been enabled to generate its own current by the addition of a 1,000-KW. D.C. Belliss set, and by rearranging the Allen sets to work as balancers and motor-generators. The number of units sold to consumers amounted to 5,477,657, as against 4,522,454 in the previous year, the units for the month of July being 1,209,175, compared with 925,487 for the previous July. The car-miles run were 170,024, against 154,376 for the previous year; passengers carried 1,544,566, against 1,291,781; and fares £20,443, against £16,875. Average receipts per car-mile 2s. 4·84d., against 2s. 4·8d. for 1907-8. The estimated expenditure for the year is as follows:—

Power station improvements	£67,000
Tramway extensions	58,000
To improve day supply in suburbs	1,275
To improve street lighting by "Osrams" ...	3,000
Suburban mains extensions	36,650

The estimated profit for the new year by the gas and electricity department is £82,000, and by the tramways £46,000.

In connection with the power station improvements, it is stated that the maximum demand in June last was 5,400 KW., while in 1910, 1911 and 1912 it is estimated to be 6,400, 7,400 and 8,400 KW. respectively. The normal existing plant capacity to-day is 5,600 KW., so that since June 23rd last it has been found necessary not to accept applications for light and power. The additional generating plant authorised in July last, at an estimated cost of £58,000, will meet all demands for load up to 1911.

In connection with the tramway extensions, the following are the details of the chief extensions to be carried out under the amount voted:—Extend Fordsburg tramway to station, £6,410; Bezuidenhout Valley line to south side, £6,500; extend Parktown West line to Rosebank terminus, £13,836; duplicate Parktown line from Ridge to Zoo, £3,800; extend Auckland Park line to Helville, £6,800; and extend Newtown line to Brixton, £19,295.

South Shields.—The annual report of the Corporation's electricity undertaking has just been issued by Mr. J. H. Cawthra, the engineer. It states that the result of last year's working is satisfactory, considering trade depression and the advent of the metallic-filament lamp. The capital expenditure is £182,268, an increase of £4,830. The revenue for the year ended March 31st last, was £25,559, compared with £25,608 in the previous year, a decrease of £48. The total costs chargeable against revenue for the year were £13,003, against £13,537, a decrease of £534 compared with the previous 12 months. The gross profits were £12,555, against £12,070, an increase of £485. The amount required this year for interest and sinking fund was £11,371, compared with £10,711, an increase of £660. The surplus, after meeting all charges, was £1,184. The net profit was down by £193. The total number of units sold was 3,127,039, an increase of 172,049. During the past year the works costs had been reduced to 0·62d. per unit, and the total operating costs to 0·998d.

On the 17th inst. an inquiry was held on behalf of the L.G.B. into the application by the Corporation for sanction to borrow £3,735 for the purposes of the electrical undertaking. The town clerk said that £2,600 of the amount sought to be borrowed was required for the purpose of duplicating the power mains in order to prevent any stoppage in the supply of current to the docks, shipyards and other industries; £135 was to provide two 1,000-ampere traction-feeder panels for the existing board; and £1,000 was required to connect up new consumers. After evidence had been taken the inquiry was adjourned.

Swinton and Pendlebury.—With regard to the recommendation of the Committee that the Council should appoint its own electrical engineer in place of the present arrangement of management by the Lancs. Electrical Power Co., for which the Council pays £1£6 per annum, the Council has deferred decision pending an interview between representatives of the Council and the Power Co. The Committee considers that the present arrangement is not consistent with true business principles, as the company is the supplier of energy in bulk to the Council, is manager of the distribution and supply to customers on behalf of the Council, and is contractor both to the Council and the consumers.

Watford.—The U.D.C. is to call the attention of the Herts C.C. to an offer made by the latter body in July, 1905, to take electricity from the U.D.C. for the working of the proposed tramways at Watford at a price to be agreed upon, or in default of agreement the price to be fixed by the B. of T. It was mentioned at a meeting of the District Council that the County Council is now about to obtain tenders for the construction of the tramways. The Urban District Council has instructed its engineer to ascertain the names of owners and occupiers outside the area who desire a supply of electricity.

Worcester.—The T.C. has received from the L.G.B. sanction to a loan of £656 for the plant for storage and handling of coal at Hylton Road electricity works.

TRAMWAY and RAILWAY NOTES.

Argentine.—The Chamber has adopted a Bill authorising the construction of an underground electric railway running across the city of Buenos Ayres from east to west. This is stated to represent a victory for English interests, as the railway will operate in conjunction with a British-owned tramway system.

Colwyn Bay.—Arising out of a joint conference between the Llandudno and Colwyn Bay Electric Railway, Ltd., and the U.D.C., the company has written stating that the directors were unanimous in their view that the question of the construction of any extension of the tramway line could not be taken up unless it was to be extended from the present terminus to the Queen's Hotel, Old Colwyn. The company proposes to apply to the B. of T. for an extension of time to construct this part of the railway until September 30th, 1910. The Council has decided to accept a sum of £5,000, payable on January 1st next, in addition to what has already been paid by the company, and the company to release the Council in respect of £500 towards the Combermere Lodge improvement. The Council, on the condition that this payment be made, will support the application for an extension of the powers.

Croydon.—The completion of the tramway system between Croydon and London by the opening of the L.C.C. extension from Streatham to Norbury (the Croydon terminus) has been followed by the withdrawal of the motor-'bus service in operation in Croydon since July of last year. Apart from this, the new development has had important results for the Croydon undertaking. On 12 Saturdays and Sundays since the through bookings have been in operation the increase in takings totalled £794. The weekly increases for the first five weeks of the through bookings, as compared with the corresponding period of 1908, totalled £1,711. With the absence of motor-'bus competition and increase of receipts due to the link with London, the prospects of the Croydon tramways have taken a very favourable turn.

Horbury.—The U.D.C. has resolved not to consent to the application of the Wakefield and District Light Railways Co. to the B. of T. that the powers with regard to the portion No. 1 of the line in Horbury shall cease.

Keighley.—The Tramways Committee of the T.C. has recommended that application be made to the B. of T. for a prov. order to construct a circular route of tramways from Devonshire Street to West Lane, and from South Street to Lynum Street, linking up the first line at West Lane. Another line from the Ingrow terminus to Whins Wood is proposed.

Rawtenstall.—The T.C. has decided to take steps with a view to laying tramways in the Whitewell Valley in order to meet the wishes of the residents in that growing district. A petition signed by 1,285 ratepayers there has been presented to the T.C. asking that tramways should be constructed.

Shrewsbury.—The T.C. has agreed to advance £500 to the Shropshire and Montgomeryshire Light Railway Co., which intends carrying out a light railway scheme at a cost of £32,000.

Continental Notes.—AUSTRIA.—The horse tramways in Klagenfurt, Carinthia, are to be converted to electric traction.

SPAIN.—The Compania del Tranvia Urbano, Bilbao, is authorised to convert its present horse tramways into electric tramways, and to widen the gauge of certain lines. The Compania Vizcaina de Electricidad has applied to the Direccion General de Obras Publicas, Madrid, for a concession for the construction and working of an electric tramway from Avanzada to Algorta.

SWITZERLAND.—The Compagnie du Chemin de Fer du Birsigtal, of Bâle, has been granted a concession for the construction and working of a metre gauge, single track, electric railway from Bâle to Rodersdorf *via* Flühen.

ITALY.—The *Gazzetta Ufficiale* publishes the terms of a contract granting to the Società Elettrica Comense "A. Volta" a concession for the construction and working of an electric tramway from Camerlata to Appiano and Mozzate. The concession will be for 60 years, and will carry with it for a period of 50 years from the date of the opening of the line, a State subsidy of £56 per km. yearly.—*Board of Trade Journal.*

RUSSIA.—The central power station which is (according to *Electric Traction Weekly*) being erected to furnish power to the electrified tramway system of St. Petersburg, contains three 2,200-KW. Westinghouse turbo-generators supplying three-phase current at 6,600 volts and 25 cycles; these units are provided with surface condensing plant. The steam raising plant includes 12 water-tube boilers, the gases discharging through two sets of economisers in parallel to two chimneys. The excitation is provided for by steam and electrically-driven generators and a battery; H.T. oil switchgear controls the output of the turbine sets, being installed in a separate fireproof building. The distributing system is arranged in duplicate, and the station is arranged for ultimate extension to 18,000 KW. capacity.

Venezuela.—The Compania Anonima Tranvias Eléctricos de Caracas is to extend its system from Palo Grande to the Nuevo Matadero.

Wolverhampton.—The Lea Road section of the Corporation tramway undertaking was formally inspected by Col. Yorke on behalf of the B. of T. last week.

York.—In view of the impending conversion of the tramways to electrical working, the existing horse service was discontinued last week.

TELEGRAPH and TELEPHONE NOTES.

Cable Interruptions:—

Tangier-Cadiz	... May 19, 1909
Tourane-Amoy	... June 17, 1909
Assab-Perim	... July 8, 1909
Dakar-Conakry	... August 20, 1909
Balikpapan-Kwandang ...	... Sept. 2, 1909
Cheiksaid-Perim	... Sept. 15, 1909

Transvaal.—According to the *Board of Trade Journal*, underground telephonic communication has been established in one of the Rand mines, and the installation of telephones underground is likely to be carried out on other mining properties.

Iron Telegraph Poles.—It is reported that a Mr. J. H. Skinner, of Durban, has invented an improved telegraph pole of cast-iron, consisting of sections 5 or 6 ft. long, which can be put together on site. The poles are manufactured at Wentworth, near Durban.

Telephone Amalgamation.—It is reported that the American Telephone and Telegraph Co. has acquired £3,200,000 worth of the New York Telephone Co.'s stock owned by the Western Union Telegraph Co. This ensures in the near future the consolidation in a single huge telephone company, of the Bell Telephone Co. and its subsidiaries working in New York State.

Wireless Telegraphy.—The Postmaster-General has announced that it is proposed to renew the Wireless Telegraphy Act to the end of next year by means of the Expiring Laws Continuance Bill.

Funds are being raised for the erection of a wireless station on or near the summit of Mont Blanc, which is close to the frontiers of France, Italy and Switzerland.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Telegraph and telephone material for the P.M.G., Melbourne. See "Official Notices" September 10th.

Common battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" to-day.

Austria.—The Austrian State Railway authorities at Prague have just invited tenders for the establishment of an electric lighting installation at the railway station at Wiesa-Oberleutensdorf.

Belgium.—September 29th. La Société Nationale de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply and erection of the overhead equipment and the return rail of the Anderlues-Lobbes section of the Carnieres-Thuin electric railway.

Birkenhead. — September 30th. Electrical sundries (Form No. 13) for the Mersey Railway Co. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Bridgend.—September 25th. Electric light installation at the Cottage Homes, for Bridgend and Cowbridge B.G. P. J. Thomas, architect, Bridgend.

Canada.—Toronto.—October 28th. (Extended from October 14th).

Electric motors for the city of Toronto four 1500-h.p. synchronous motors; two 1,500-h.p. induction motors; four 500-h.p. synchronous motors; four 500-h.p. induction motors; two 225-h.p. synchronous motors; with exciters, switchboards, connecting material, &c. Specifications and forms of tender may be obtained on application to the City Engineer.

Turbine pumps as follows:—

Four 13½-million gallon pumps, 100 lb.
Two 5-million gallon pumps, 300 lb. pressure.
Two 10-million gallon pumps, 65 lb. pressure.
Two 10-million gallon pumps, 110 lb. pressure.
Two 6½-million gallon pumps, 90 lb. pressure.
Two 6½-million gallon pumps, 160 lb. pressure.
Two 1½-million gallon pumps, 65 lb. pressure.
Two 1½-million gallon pumps, 110 lb. pressure.
With valves, piping, bed-plates, couplings, &c.

Specifications and forms of tender for these also may be obtained from the City Engineer.

Colchester.—September 28th. 5,000 tons of steam coal for the electricity works. Mr. A. R. Sillar, borough electrical engineer.

Glasgow. — October 4th. The Corporation invites tenders for the general supply, delivery and erection of mains, switchboards, distribution boards, cables, switches, &c., wiring and accessories for transmission of electrical power to motors, &c., and for lighting at their Shieldhall sewage purification works. Specifications from the Office of Public Works, 64, Cochrane Street, Glasgow.

Halifax.—September 28th. Electrical fittings for six months, for the B.G. A. T. Longbotham, Clerk, 4, Carlton Street.

Isle of Thanet.—Stores for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 3rd.

London.—October 4th. Electric wires and cables, lamps, carbons, switches, fuses, telephones, cells and electrical insulating materials for the Metropolitan Railway Co. for a year. W. H. Brown, secretary, 32, Westbourne Terrace, W.

Oulton Broad.—The U.D.C. invites applications from those willing to carry out its E.L. order. See "Official Notices" September 10th.

Rotherham.—October 23rd. The T.C. has two steam-dynamos, 32 kw. each, for disposal. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Paterson Engineering Co., Ltd., have received from the Admiralty a repeat order for oil-eliminating plant with quartz sand filter for H.M. dockyard at Chatham, together with steel carrying structure and pipework. The total capacity of the Paterson purifying plant at this station will now be 10,000 gallons per hour. Paterson oil eliminators are also installed at H.M. dockyards, Pembroke, Portsmouth, Gibraltar, Priddy's Hard victualling station and Portland permanent coal depôt.

Bromley (Kent).—The T.C. has accepted the tender of Horsfall Destructor Co., Ltd., for plant, &c., for the refuse destructor, at £565.

Canada.—Our correspondent writes:—The city of Winnipeg has awarded the contracts for electrical apparatus in connection with the power plant at Point Du Bois, which are $157,000 lower than the best tenders recommended in October, 1907. The total of the contracts awarded amounts to $425,000, and the successful tenderers for the larger items are British firms:—

Turbines.—Jens Orten-Böving & Co., London, $97,150; $11,000 for erection
Generators and exciters.—Vickers, Sons & Maxim, Ltd., Sheffield, $93,080 this price includes erection.
Transformers, switching and protective apparatus.—Canadian Westinghouse Co., Ltd., Hamilton, $150,800.

The other smaller contracts are given to Canadian firms.

Golden & Lanseng, of Troy, New York, has secured the contract for the City of Toronto's new electrical distribution plant, and work has commenced. The laying of the conduits is to cost $65,800 or £13,180.

Dundee.—Mr. T. C. Keay has secured the contract for the electric lighting of Dudhope Museum. The supply will also be used for working a large number of models, which have been installed for educational purposes.

Elland.—The U.D.C. has accepted the tender of Messrs. J. Newsome & Sons for coals at the electricity works for the nine months ending May, 1910.

Fulham.—The Council has just placed a contract with the Beeston Manufacturing Co., of Leeds, for 288 special lanterns and brackets in connection with improvements they are making on the Fulham Palace Road tramway route. These brackets are specially designed for placing on tramway poles, and the new arrangement will replace about 48 arc lamps and posts. The necessary switches for these lamps have been ordered from the Reason Manufacturing Co., Brighton.

Contracts have also been placed with the Stirling Boiler Co., for two of their patent water-tube boilers, having a capacity of 14,000 lb. per hour each, and with the Underfeed Stoker Co. for two stokers and accessories, to work in connection with the new boilers.

Norway.—The A.G. Brown, Boveri & Cie., of Baden, Switzerland, has recently obtained one of the largest orders for electrical generating plant ever placed in Europe. This consists of five three-phase generating units, each rated at 17,000 k.v.a. (at 0·6 power factor), at 10,000–11,000 volts and 50 cycles, with direct-coupled exciters of 130 kw., for coupling to water turbines of 14,000 h.p at 250 r.p.m. This generating plant will form one-half of the power equipment of the new generating station now being built for Messrs. A. S. Rjukanfos, of Christiania, for the production of saltpetre from atmospheric nitrogen, which station, when completed, will be the largest in the world. Messrs. Brown, Boveri and Co., Ltd. (London), to whom we are indebted for the foregoing particulars, in referring to the extremely severe character of furnace work of this description, mention that the weight of one of these generators is about 200 tons, the diameter being nearly 20 ft. They add that the above order was obtained in competition with the leading firms of the Continent, and that it was settled upon the technical merits of the designs, and not upon considerations of price; and, further, that the A.G. Brown, Boveri & Cie. have no financial interest whatever in the undertaking.

Government Contracts.—The following tenders have been accepted for the Government Departments named:—

WAR OFFICE.

Dynamos.—Siemens Bros. Dynamo Works, Ltd.
Lamps, electric arc.—Siemens Bros. Dynamo Works, Ltd.

GENERAL POST OFFICE.

Cable, india-rubber and cotton core.—W. T. Henley's Telegraph Works, Co., Ltd., Johnson & Phillips.
Cable loop.—British Insulated and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.; Western Electric Co.
Cable, paper core.—British Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Western Electric Co.
Cup-holders, galvanised steel.—Bullers, Ltd.
Insulators.—Taylor, Tunnicliff & Co, Ltd
Lamps, tantalum.—Siemens Bros. Dynamo Works, Ltd.
Machine, testing.—Joshua Buckton & Co., Ltd.
Pipes, cast-iron.—Bailey, Pegg & Co., Ltd.
Spindles, insulator.—F. W. Cotterill, Ltd.; Guest, Keen & Nettlefolds, Ltd.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.; British Insulated and Helsby Cables, Ltd.; General Electric Co., Ltd.; International Electric Co.
Transmitters, telephone.—Western Electric Co., Ltd.
Electric lighting at Newton Street Sorting Office, Manchester.—J. Collier and Co.
Equipment at the Post Office Central Telephone Exchange.—Western Electric Co.

Keighley.—The Tramways Committee for the T.C. has accepted the tender of Messrs. Grace & Sutcliffe for two motor chassis, at £1,303.

Leicester.—The Coporation Tramway Department has placed an order with Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, for two pairs of "Bennis" smokeless and gritless high temperature coking stokers and compressed air furnaces for 8 ft. 6 in. Lancs. boilers at the generating station, Belgrave Road. This is a repeat order.

Leyton.—For installing the electric light at the extension of the public offices, the U.D.C. received the following tenders:—

H. J. Whitehead, Wandsworth	(accepted)	£233
E. E. Beaven, Dartford		296
British Westinghouse Co., Ltd.		375
Electrical and Motor Co., Banbury		239
Felgate & Storey, Reading		473
T. J. Halsey, Stratford		260
Johnson & Phillips, Ltd.		240
W. E. King, Barnet		311
Larkins & Co., London		340
Malcolm & Allan, London		355
Newbold & Co., Sutton		321
Nunn, Watts & Co., London		309
Rowland & Hulton, London		335
Russell, Bridger & Co., Putney		360
Saunders & Co., London		315
Tilley Bros., London		330
Vaughan Engineering Co., London		375
Wells, Rayner & Co., London		299
Weston & Sons, London		255

The following tenders were received for 100 public lighting lanterns with clock switches, and have been referred to the Electric Lighting Committee:—

Electrical Joint-Box Compound Co., Blackheath, S.E. ..	£207
General Electric Co., Ltd.	525
Haydon Harrison, London	345
Lucy & Co., Ltd., Oxford	317
Pontifex & Co., London	307
Reason Manufacturing Co., Brighton	350
Bertram Thomas, Ltd., Manchester	442
Tilley Bros., London	333
Venner & Co., London	330

Pretoria.—The A.E.G. Co.'s tender of £3,740 for a generating set with necessary spares has been accepted by the Pretoria Town Council, also Messrs. Reunert & Lenz's tender of £2,508 for a boiler, feed pumps, &c.

Rawtenstall.—The T.C. has accepted the tender of the D.P. Battery Co., Ltd., for the maintenance of the battery at Hareholme electricity works.

The Rand.—According to an exchange a number of large mill motors, of 400, 240 and 165 H.P., are on order with Messrs. Dick Kerr & Co., Ltd., in connection with the electrification of the Rand Mines, Ltd.

Wakefield.—The B.G. has accepted the tender of the Wakefield Electrical Engineering Co. for electrical work for six months.

West Ham.—The Education Committee has received the following tenders for the installation of electric light at the Abbey School:—

Alliance Electrical Co.	£383	H. J. Whitehead	£204
W. R. Woodward	162	E. P. Allam & Co.	297
Troup, Curtis & Co.	247	Vulcan Electric Co.	286
C. Larkins & Co.	356	Jackson Bros.	279
West Ham Corp. Elec. Supply ..	330	J. T. Halsey	278
Whitehead Bros.	316	G. Weston & Sons	264
Pinching & Walton	311	Pemberton, Arber & Carey ..	249
W. Simmons	306	**Rowland & Hulton** .. (accepted)	226

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, September 25th. At 3 p.m. Visit to the Imperial International Exhibition, Shepherd's Bush.

Society of Engineers.—Monday, October 4th. At 7.30 p.m. At Caxton Hall, S.W. Prize essay on "The Status of the Engineering Profession," by G. A. Thomas.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 2nd, 1909:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, September 27th.—"A" Company. Technical drill, 7 to 9.30 p.m.
Tuesday, September 28th.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, September 29th.—Gymnasium, 6.30 to 9.30 p.m.
Thursday, September 30th.—"C" Company. Technical drill, 7 to 9.30 p.m.
Friday, October 1st.—"D" Company. Technical drill, 7 to 9.30 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjutant. For O.C. E.E. (L.D.)

NOTES.

Liability for Tramway Accidents.—The Association of German Tramway and Secondary Railway Administrations, at the recent annual congress held at Hamburg, decided to address a petition to Parliament praying that the liability of tramways in regard to accidents should be placed upon an equality with that applicable to motor-cars. Dr. Wuspsow, of Berlin, who brought forward the question in the course of a report, stated that tramways were subject to the strict provisions of the Ancient Imperial Liability Act of 1871, in the case of injuries caused to persons, although the peculiarity of their development had long since demanded a special regulation as to the liability of tramways. The interests associated with horse vehicular traffic now desired to extend the provisions of this law to the subject of material damage caused by tramways, nothwithstanding that, as proved by statistics collected since 1900, on an average 60 per cent. of the recorded collisions have been due to the fault of the "foreign driver," and only 11·4 per cent. to that of the tramcar driver. In the circumstances, the author had come to the conclusion that a special liability law was needed for tramways which would correspond with the general feeling of right, and he expressed the opinion that the new Automobile Act contained almost everything which would suit the tramways from the point of view of liability.

Electric Shock Fatality.—Coroner J. T. Proud held an inquiry on the 17th inst. into the circumstances of the death of John Dent Thompson (27), pump attendant at Shildon Lodge Colliery, County Durham, who was found dead behind the electrical switchboard in the mine, on the 7th inst. The Home Office was represented by Mr. Nelson. Mr. R. Bell, the manager, said the deceased's duties were merely to attend to the pump. He thought Thompson had gone within the fence to adjust one of the terminals which had been "sparking." William Bryce, generator attendant, said Thompson telephoned from the Brockwell seem that "she was hot," but he would be able to start soon. Witness thought "she" referred to the pump. William Hepburn, the electrician, said after the accident he went to the place. There was a terminal which had been moved, and to reach that Thompson would have to pass two charged wires. There were burns on two fingers and a thumb of the deceased, and these could have been caused by the terminal. The man might have touched something when attending to the terminal. The voltage was 2,400. The jury returned a verdict of "Accidental death."

Ozone Works at St. Petersburg.—In view of the unsatisfactory results obtained during the cholera epidemic, which has lasted more than a year, in connection with the purification of the water of the Neva by means of ordinary sand filters, the water distribution system being exposed to constantly renewed cholera infection, the municipal Duma and city authorities have decided to adopt the ozone process for the sterilising of drinking water, and to erect a large ozone water works. The sanitary authorities, both of the City of St. Petersburg and of the State, are, in fact, of opinion that only by the ozone method will effective purification of the drinking water of St. Petersburg be obtained, as their own investigations, in accordance with those of the German Imperial Sanitary Office and the Pasteur and Koch Institutes, have shown ozone to be the safest means of ensuring the complete destruction of bacteria in water. The large ozone works, which is to be installed in connection with what is called a "rapid filtering plant" (Howatson system), is to be designed according to the combined Siemens-De Frise, Otto ozonising system. The electrical part and the ozonisers will be constructed by the Siemens and Halske Co., and the Felten-Guilleaume Lahmeyer Works.

Commemoration Dinner of the International Correspondence Schools.—If means can ensure the really practical value of an educational course in electrical engineering, the expenditure of so great a sum as upwards of £15,000 on the preparation of the details of that course should place its worth beyond all question. Such is the outlay that Mr. E. A. Seitz, the managing director of the International Correspondence Schools, assured the guests at a banquet of that institution at the Hotel Cecil on the 18th inst., had been made on the I.C.S. electrical engineering course. Considering that there are 210 I.C.S. courses of instruction, covering every branch of commercial and industrial activity, the scale of its operations may be recognised as very large

The preparation of all the courses is said to have involved a capital cost of about £300,000, while about £50,000 is spent annually in revising them and keeping them up to date.

Last Saturday's banquet was held in view of a special visit of students and representatives of the International Correspondence Schools to London, and about 400 of those who were interested in the work sat down to dinner in the Grand Hall of the hotel. Sir Thomas Brooke-Hitching, himself a satisfied investigator of I.C.S. instruction, took the chair in the unavoidable absence of Lord Montagu of Beaulieu. Among those present were Mr. L. A. Atherley-Jones, K.C., M.P.; Mr. Dennis Hird, M.A., of the Central Labour College, Oxford, and several gentlemen connected with various scientific institutions.

In response to the toast of "The International Correspondence Schools," Mr. Seitz gave a brief sketch of I.C.S. work. While not claiming for the I.C.S. absolute originality in postal educational instruction, seeing that ancient Babylon had been found to possess such a service, he said that a twentieth century postal system was kinder to the extension of their work than the expensive transmission of the Babylonian tutorial bricks. He succeeded in convincing his hearers that the International Correspondence Schools pervaded all countries and were capable of everything. Only that week Mr. Seitz had had word from an I.C.S. student that he intended competing for the *Daily Mail* aviation prize of £10,000. The name of Mr. T. J. Foster, the American founder of the International Correspondence Schools, was enthusically received.

Better evidence as to the adaptability of I.C.S. technical instruction could not have been afforded than that contained in two illustrations put forward by Mr. Seitz. One was the quick rise of a student from a labourer's low salary to £6 per week as superintendent of a large manufacturing firm's engineering plant. Another, a motorman, who had taken I.C.S. instruction, was now general manager of one of the largest municipal electric tramway systems in the country. More striking still, perhaps, was Mr. Seitz's statement that only recently Sir Charles Elliott, late general manager of Government railways in South Africa, had called at the International Correspondence Schools' new London headquarters in the International Buildings, Kingsway, and had there told him that he, Sir Charles, had observed the value of the I.C.S. tuition in South Africa, and had, in fact, taken a short course himself, and now wished to enter for the full mechanical course. Other remarkable statistics showed that in the British Empire there were now 100,000 I.C.S. students, over 1½ million having been enrolled in the schools all over the world. The I.C.S. was not in competition with evening classes, as its students, averaging between 26 and 27 years of age, were mostly those who would not sit in evening classes by the side of youths.

The testimony of Mr. Dennis Hird that the I.C.S. was a real force for the betterment of mankind was listened to with attention. Altogether, the evening reflected in a strong light the usefulness of a big educational institution.

Electric Shock Accident.—Our Dundee correspondent says that a miner employed in No. 23 pit, Wallacestone, Stirlingshire, has been seriously injured through coming in contact with the electric cable. It was found that the bones of his left hand were calcined, and will have to be removed.

Aviation Dangers.—We have on previous occasions noted accidents to balloons through fouling telegraph wires; more serious conditions are met with by aeronauts abroad. According to the *Times*, the aviator Nassr recently made an ascent at Ottawa in an aeroplane. While he was ascending, the propeller became caught in an electric wire, causing it to fall to the ground. Four persons received shocks, and two were taken to a hospital.

Parliamentary.—In the House of Commons on September 21st, Mr. Markham asked the Chancellor of the Exchequer if he would state the reasons which caused him to refuse the request of the Mines Royal Commission for a grant to make experiments on the use of electricity in mines; and whether, in view of further recent explosions believed to be due to electricity, causing the loss of large numbers of men, he would reconsider his decision in this matter. Mr. Hobhouse replied: My right hon. friend has not received any such request from the Royal Commission. Mr. Markham: Is the right hon. gentleman aware that in the report of the Royal Commission it was definitely stated that the Chancellor of the Exchequer refused to make this grant? Mr. Hobhouse: My attention has not been drawn to that statement. I am prepared to look at it. My information is as I have given it to the hon. gentleman.

Royal Assent.—The following Acts have received the Royal Assent:—

Electric Lighting Orders Confirmation (No. 1) Act, 1909.
Tramways Orders Confirmation Act, 1909.

Town Planning Bill.—Mr. Clough asked in the Parliamentary papers, whether the President of the Local Government Board could give any assurance that in the event of a local sanitary authority acting as a responsible authority under the Housing and Town Planning Bill for a town planning scheme within the area of a neighbouring authority, the latter would retain all its duties and powers as regarded the provision of sewerage, water supply, lighting and consequential works throughout its own area, and that none of such powers and duties would pass to the responsible authority by virtue of any regulation hereafter made under that Act by the Local Government Board.

Mr. John Burns, in reply, stated that it was not intended that the powers and duties of a neighbouring local authority should be transferred to the local authority responsible for the execution of a town planning scheme. These powers and duties would not be interfered with, except in so far as it might be necessary in order to secure the carrying-out of the scheme. For example, it might be necessary to provide that they should be exercised in some particular way.

National Telephone Co.—Replying to a question by Mr. Lloyd Morgan, who asked in the Parliamentary Papers whether, in view of the approaching taking-over of the business of the National Telephone Co. by the Post Office, the privileges enjoyed by the telephoning public would be in any way restricted when under the Government, and whether it was proposed to make any change as to the use of the telephone on Sundays, Mr. Sidney Buxton said he did not anticipate that the present facilities would be restricted. As to the question of Sunday use, that would require very careful consideration.

Canadian Development.—The minimum-flow development of all the water-powers of Canada, according to Mr. J. B. Challies, of the Canadian Department of the Interior, is estimated at over 25,680,000 H.P., of which about 516,900 H.P. has been utilised. Hamilton River, in the Labrador Peninsula, is the largest available power, with a possible development of 9,000,000 H.P., Niagara Falls being second to it.—*Electrical World.*

Meters on Tramway Cars.—As might be expected, papers read on traction subjects bulk very largely in American engineering proceedings, and as in this country, the question of energy consumption on cars has come to the front. Quite recently a paper on the subject, read apparently with the view of putting forward the claims of the mercury-motor meter for this class of work, elicited some interesting discussion. Thus it appears that seven trips, under test conditions, on the loop and metropolitan sections of the West Side Co., Chicago, showed energy consumptions of 3·67 and 2·30 KW.-hours per c.m. respectively, using a 33-ton motor-car and 16-ton trailer. Seven carelessly-driven trips showed energy consumptions of 4·29 and 2·90 KW.-hours respectively. An average gain of 2 per cent. in time and an excess of energy consumption of 26 per cent. occurred in the last seven trips. The higher energy consumption on the loop was due to frequent stopping and starting.

In view of the above, the operating efficiency of each motorman, as regards power consumption, will in future be entered on his record of service, a copy of each entry being sent to him. At Cleveland a series of tests of energy consumption on city and inter-urban cars, 14 of each kind being tested, showed that while the inter-urban cars weighed 50 per cent. more than the city cars, the energy consumption of the former averaged 3·75 KW.-hours per car-mile, against 3·84 KW.-hours in the latter case; this is equivalent to 88 watt-hours per ton-mile, against 125 watt-hours—the difference being due to the inter-urban stops averaging 15, against 65 in the case of the city cars. It was considered a good plan to keep a man on testing work, but a meter equipment on every car was prohibited, on account of expense.

Automatic Thermo-Electric Control.—A patent was issued to Mr. H. Ward Leonard on March 23rd relating to the automatic control of the energy supplied to an electrically-heated tool. The patent states that if an electrically-heated flatiron be used to iron damp goods as rapidly as possible, the iron becomes chilled, or if this difficulty be overcome by increasing the watts, then, when the iron is idle, it is likely to become destructively overheated. What is needed is a wide variation of the current, automatically controlled as needed to maintain a definite temperature, irrespective of whether the iron is idle or being worked to the limit.

The invention provides in the flatiron, in addition to the heating wire, an auxiliary controlling resistance of nickel or other material, whose resistance responds immediately to a change of temperature. This change of resistance affects an exterior automatic magnetically-controlled switch in series with the controlling resistance, and the automatic switch, thus made responsive to a change in the temperature of the flatiron, is caused to vary the heating current as required. Thus, in practice, as soon as the iron is worked to the limit, this exterior automatic switch cuts out the exterior controlling resistance, and causes the iron to take, say, three or four times as much energy as when it was idle. When the iron is set aside, and tends to heat up under this very large working current, the automatic switch immediately inserts the resistance needed to prevent the iron from becoming overheated.—*Electrical World.*

Large Electric Organ.—One of the largest electric organs ever built in the United States, according to the *Scientific American*, is about to be erected in the Auditorium at Atlanta, Ga. It will be played from a movable four-manual control 65 ft. away by an 8-volt current from a specially wound generator, and blown by a 20-H.P. motor direct connected to a series of fans raising the air pressure by steps.

Educational.—British Correspondence School of Electrical Engineering.—We are informed that this institution has added a course on "Aeronautics" to its syllabus; the course covers dirigible balloons, the problems of flight, aeroplanes, motors and propellers, and is divided into nine lessons. The subject is a fascinating one, and as M. Blériot, for instance, has already received orders for over 100 monoplanes, it is clear that a new industry is in course of development.

As the result of the inquiries which we have made as to the special facilities provided for the benefit of charge engineers and others who cannot attend continuously a course of evening classes, we have ascertained that the following institutions afford such facilities :—

University College: Faculty of Engineering.—Special courses for engineers in practice and graduates in engineering. The Electrical Engineering Laboratories are open daily from 10 to 5 (Saturdays 10 to 1). Shift engineers can attend at any time within these hours, and can also attend the day courses in electrical engineering. Particulars from the Secretary.

East London College.—Alternative day classes are provided in order to assist shift engineers. Apply to the Registrar.

Northampton Institute.—The subject has received consideration, and suitable arrangements will be made if a sufficient number of applications is received. Apply to the Principal.

The Polytechnic, Regent Street.—The evening lectures are repeated on a convenient morning, removing the disability of shift men almost entirely. Apply to Mr. W. Hibbert.

South-Western Polytechnic Institute.—Shift engineers are allowed to attend the ordinary day classes and laboratories when on duty in the evening. Apply to Mr. A. J. Makower.

On the whole, it is clear that little more can be done than is already done, without co-ordinate action on the part of both the would-be students and the various teaching institutions. The former should write *at once* for particulars of the arrangements made on their behalf, as the new session is already under way.

Copper.—A writer in the *Financial Times*, for September 18th, on the copper outlook, is rather inclined to the view of peace and increased production. The U.S. Copper Producers' Association statistics quoted by him show for August last an increase of 1,000 tons over the output for the previous month, or at the rate of 645,000 tons per annum. The statistics for last year were:—U.S. output, 425,000 tons; Spain and Portugal, 52,000; Japan, 43,000; Australasia, 39,000; Chile, 38,000; Mexico, 37,000; Canada, 28,000; Germany, 20,000; Russia, 20,000, and Peru 15,000. With regard to the U.S. production which, of course, sways the market, the writer says:—"It is believed, however, that the limit of this expansion has now been to all intents and purposes reached, the present rate of output being very considerably in excess of that of last year."

Messrs. Merton's statistical summary for the first half of September shows visible supplies at 90,387 tons, an increase of only 2,169 tons on the return for the end of August. This still consists largely of stocks in English ports, French stocks being 6,119 tons, and afloat 7,500 tons (Chile and Australia). Supplies from North America appear to be down a little; from Spain to this country up to the average. The total supplies are 18,413 tons, and deliveries 16,244, which works out at average deliveries, but lower supplies for the month.

The Manufacture of Nitrates from the Air.—Of the many attempts to produce nitrates from the air few have gained any public notice. This has been due largely to the impossibility of carrying out on a successful commercial scale what is a matter of considerable ease in an experimental way. With the exception of the Birkeland-Eyde process, little is known of the practical manufacture of nitrates from the air. Details of the method employed by Schönherr have been boomed to a considerable extent, but as yet nothing is known of the manufacturing scale. It is of interest to learn that another process is being successfully applied commercially, details of the operation forming the substance of a paper by Dr. Franz Russ before the Verein Oesterreichischer Chemiker. The principle involved is similar to that utilised in other methods. It is necessary to produce a large electric flame capable of absorbing large amounts of power. The method adopted is very simple. Two conductors are arranged almost to meet at one end, but widen out at the other. Between the converging ends of these conductors a hot blast of air is driven. An arc is struck across the short gap between the conductors, and is forced along the latter by the hot blast in a continually widening flame, which is broken for every half period of the alternating current used. In this manner a rapid succession of arcs are formed, which have the appearance of a quietly-burning flame. The electrodes are made of iron, and are cooled with water; they last about 200 hours when producing a flame 1 yard long. The hot gases, after passing through the flame, are cooled by means of a second blast of air, which also serves the purpose of elongating the flame. In this manner oxides of nitrogen are produced up to a concentration of 1·5 per cent. In practice two arcs are struck in one furnace in order to concentrate the energy consumption. Each furnace requires 400 kw., current being supplied at 4,000 volts. Through the lower air passage 600 cb. metres of air are blown per hour. In a factory erected at Innsbruck 24 furnaces are now in use. The furnace gases have a temperature of 700-800° C., and are used for the manufacture of both nitric acid and sodium nitrate. The large amount of heat in these gases is utilised for the concentration vats and for preheating the air blast. Nitric acid is condensed in a series of earthenware pipes and towers when a strength of 40 per cent. is obtained. This is further concentrated by means of the furnace gases up to 60 per cent., and placed on the market in this form. The yield of nitric acid per kilowatt-hour is 60 grammes. The Innsbruck factory is designed for a power consumption of 15,000 h.p. Two other factories are in process of construction—one in the South of France and another in the North of Italy—each to consume 10,000 h.p. The inventors of this process are the Bros. Pauling.

Institution and Lecture Notes.—Municipal Tramways Association.—The eighth annual conference of this Association was opened on Wednesday last at the London County Hall by an address, welcoming the delegates, given by Sir Melvill Beachcroft, J.P., Chairman of the Council. In his address Sir Melvill Beachcroft remarked that four years had elapsed since the Association met in London, and that he hoped the next time they came, the Council could entertain them in a building worthy of the capital of the Empire. He was fully conscious of the important work carried out by the members of the Conference, and trusted that during the discussions many of the knotty subjects besetting all who are engaged in tramway work would be solved. He then referred to the important position that tramwork now held in the estimation of the County Council, the rapid progress which was being made in the electrification of the tramway system in the Metropolis and the results which had so far been obtained. He held that in view of the magnitude of the issues at stake, the experiment of the installation of the stud system at Bow Road was fully justified, although as a result they felt themselves compelled to retain the conduit system. He was impressed with the importance of establishing through running between different systems, though he felt that many of those present held different opinions, and was glad to be able to refer to the establishment through the good offices of the Board of Trade of a Conciliation Board to which would be referred all questions relating to the labour conditions of the Council's 9,000 tramway employés. A hearty vote of thanks to the London County Council and also to Sir Melvill Beachcroft was then proposed by Mr. J. Aldworth, of Nottingham, seconded by C. J. Spencer, of Bradford, and carried unanimously, and the Conference settled down to listen to the address of Mr. A. L. C. Fell, the President of the Association, to which we refer in our leading columns to-day.

Institution of Metals.—At the forthcoming meeting in Manchester (October 14th and 15th), of which we gave some particulars in our last issue, each paper will be read in abstract only, ten minutes being allowed the author for this purpose, and each speaker will be limited to five minutes in the discussion. The papers will, of course, be available to members a week before the meeting. We commend this system to the notice of other societies; as we have often pointed out, it is hardly fair to the author to discuss his paper without first studying it at leisure, and it is a waste of time to read it *in extenso* at the meeting. Several local works and educational institutions will be visited. Those desiring to attend must apply to the Secretary not later than September 30th.

Institution of Mining Engineers.—The members of this Institution held their twentieth annual gathering at Newcastle-on-Tyne on the 15th, 16th and 17th insts., the two latter days being given up to sightseeing. On the 16th inst. the members visited the works of the Newcastle-on-Tyne Electric Supply Co., Ltd., at Carville, in the morning, which has a total capacity of 56,000 h.p. installed. The members also visited Harton Colliery, where there is a large electric winding engine. Sir Lindsay Wood, chairman of the company, stated that the winding engine had not been in use very long, and he could not say what was the exact saving on it, as compared with a steam-worked winding engine. He expected, however, that the use of the electrically driven winding engine would be found to be advantageous, and would tend to increased output. No steam was now used in the Harton Colliery, all the machinery being electrically driven. The winding engine is designed to deal with an output of 240 tons per hour, the motor being of 800 h.p. The cages in use have four decks, carrying two tubs on each deck. The weight on the pulleys at the start, including the rope, is 14½ tons, and the wind occupies 48 secs. The haulage engines are also electrically driven, and the horse-power of the motors installed is 1,645.

Municipal Secondary School, Hanley.—A course of lectures on "Electrical Engineering" is to be delivered at the above school by Mr. C. H. Yeaman, borough electrical engineer, Hanley, commencing to-day.

A New Mercury Ammeter.—The problem of measuring large alternating currents with any degree of accuracy is, from the technical standpoint, a difficult one. There is a distinct need for a standardisation instrument which can be inserted into an alternating-current circuit carrying 500 amperes and will record to the same degree of precision as one of the smaller instruments. As a result of observations of the forces in the interior of electric conductors, Dr. E. F. Northrup has constructed an instrument whose only limit to accuracy is that with which the unit of current is known. This ammeter is intended as a primary standard instrument for large currents, either alternating or direct. The lowest range is from 200 to 500 amperes, and the degree of accuracy at 200 amperes is 1·5 per cent. In the tests it was found that for three-quarters of the scale, the reading error did not exceed 0·1 per cent., and was quite independent of the kind of current used. The temperature coefficient is negligible, and the effect of external currents is almost inappreciable. The operation of the instrument is quite simple. The terminals are connected to the circuit without regard for polarities. The zero is first adjusted and the current switched on, when a coloured liquid flows to a point on the scale to indicate the number of amperes passing. The principle involved is entirely new, as far as instruments are concerned, and cannot be fully reproduced in abstract. It is similar, however, to the action of conductors carrying a current, which are known to attract each other and produce a certain amount of sag towards the middle. A liquid conductor can be supposed to consist of an infinite number of elemental conductors, parallel to the direction of the line of flow which will also cause the same tendency for contraction. It is this force which is utilised in the above construction. The

simplicity of construction and the ease with which it works place this new instrument in a position which is bound to make itself felt in the near future.—*E.M.I.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The salary of Mr. Turnbull, electrical engineer and manager to the Broughty Ferry Corporation, has been increased by £20 per annum.

Mr. Francis Teague, city electrical engineer of Bath, and his wife, celebrated their silver wedding on September 21st, and the staff and employés of the department presented them with a silver tea service and salver.

Tramway Officials.—Out of 108 applicants Mr. H. P. Stokes, assistant manager of the Burton-on-Trent tramways, has been appointed manager of the tramways at Ilkeston.

Portsmouth T.C. has granted an honorarium of 100 guineas to Mr. V. G. Liboni, tramways engineer, in recognition of the excellent way in which the Goldsmith Avenue tramway extension was carried out under his supervision.

General.—The Council of the Association of Engineers-in-Charge have unanimously elected Mr. Henry Adams, M.I.C.E., M.I.Mech.E., &c., as their President in succession to Mr. James Swinburne, F.R.S., M.Inst.C.E., and an attractive programme has been drawn up for the new session, including some good papers and several social functions. Among the members of the Association Mr. Adams is one of the oldest of the engineers-in-charge, having so far back as 1865 been in responsible charge in the outdoor department of Sir W. G. Armstrong & Co., of Elswick Works.

Capt. P. H. Campbell, R.E., has been appointed Adjutant to the London Electrical Engineers (Territorial Force).

We read in the Press that on Monday evening the Postmaster-General presided at a dinner given at the Grand Hotel, London, in honour of Sir Henry Babington Smith on his resignation of the Secretaryship to the Post Office, in order to take up the appointment, at Constantinople, of President of the new National Bank of Turkey. Among those present was Sir Matthew Nathan, who is to succeed Sir Henry Babington Smith, as well as the heads of the various departments of the Post Office.

Obituary.—Mr. H. C. A. Pratt.—The death is announced of Mr. Herbert C. A. Pratt, of the firm of Campbell & Isherwood, electrical engineers, Raleigh Street, Liverpool. He was only 28 years of age.

NEW COMPANIES REGISTERED.

Cunnington & Harris, Ltd. (104,982).—This company was registered on September 16th, with a capital of £5,000 in £1 shares (2,000 preference), to adopt an agreement with S. Harris, and to carry on the business of electrical engineers, electricians, workers of and dealers in electricity, motive power and light, &c. The subscribers are:—J. G. S. Cunnington, 21, North Audley Street, W., electrical engineer, one share; S. Harris, 21, North Audley Street, W., surveyor, one share; A. Harris, 79, Priory Road, West Hampstead, N.W., solicitor, two shares. Private company. Table "A" mainly applies. Directors' borrowing powers restricted, but no debentures or debenture stock shall be issued which shall rank in priority to or *pari passu* with a £250 first mortgage debenture to be issued to Mrs. S. L. Attrill, or a £500 second mortgage debenture to be issued to S. Harris. Registered office, 21, North Audley Street, Grosvenor Square, W.

Boudjah Electric Lighting Co., Ltd. (104,953).—This company was registered on September 14th, with a capital of £5,000 in £1 shares, to undertake the electric lighting of streets, public places and private dwellings in Boudjah or elsewhere, to obtain concessions for electric lighting and electric power supply in the Turkish Empire. The subscribers (with one share each) are:—D. Forbes, jun., Smyrna, merchant; T. S. Catto, Smyrna, merchant; F. W. Parry, 110, Cannon Street, E.C., secretary. Private company. The number of directors is not to be less than three or more than nine; the first are D. Forbes, jun., T. S. Catto and F. W. Parry; remuneration as fixed by the company. Registered office, 110, Cannon Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Le Radiant, Ltd. (102,296).—Particulars of £2,000 debentures created August 24th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £700. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Crompton & Co., Ltd.—Issue on August 17th of £65,625 debentures, part of series created November 15th, 1909, to secure £100,000, charged on the company's undertaking and property, present and future. No trustees. Previously issued of same series: £9,275.

Newtons, Ltd. (48,936).—An amended statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Indentures dated 1900 to 1906, securing £12,500.

The original statement omitted to give notice of debentures bearing various dates in 1900, securing £10,000.

CITY NOTES.

United Electric Car Co., Ltd.

The annual meeting of this company was held at Preston on 15th inst.

Mr. G. Richardson presided, and in moving the adoption of the report (see Electrical Review, September 10th, 1909) he said the result was an improvement on the previous year, but the output, owing to continued slackness in their special business, had been considerably below the capacity of their works and plant. Their net profit, in spite of these circumstances, was £1,800 more than last year, which clearly showed that the work they had done had been profitable. After charging debenture interest, depreciation, and all charges, there was a net profit of £8,896, from which, with the substantial amount brought forward, the directors felt justified in declaring a dividend on the ordinary shares of 2½ per cent. for the year, and after allowing for this and the preference dividend they would be able to carry forward to next year £5,333, as against the £6,187 brought into the accounts. The bank interest received showed an increase over last year of £700. Financially, they were in a strong position. Their total liabilities to creditors on June 30th was only £15,864, whereas their bank balance was £59,000, and the debtors, all perfectly good, nearly £48,000. Of course they would understand that when business was slack there was a tendency for money to accumulate at the bank, but if they should become very busy, a position they were all doing their best to bring about, this large bank balance, together with their large stock of seasoned timber, would be useful not only to enable them to make purchases on the lowest terms, but also, if thought advisable, to secure safe orders on deferred payment terms. The reserve for depreciation amounting to £34,500 had been increased since last year by £4,500. The directors believed this was a very ample reserve. The buildings were in an excellent state of repair, the machinery was as good as new, and there was nothing of an obsolete character. They continued to enjoy an excellent reputation for turning out only the highest class of work. They had always pursued this policy, and would not cut down cost by turning out cheap and inferior work. With regard to the prospects for the coming year, he observed that they were obtaining a fair share of the orders given out, although such orders were small, and he regretted that he could not see any immediate prospect of trade improving in their line of business; but when an improvement did take place they were in a most satisfactory position to meet it, both in regard to money, stocks of material and management. They had two very able officials in their secretary (Mr. Pickin) and Mr. Anger.

Mr. Mylchreest asked why the company had not gone in for the manufacture of wagons, which appear to have been contemplated in the original prospectus. He also wished to know if they had sold the Old Trafford and Hadley Works.

The Chairman replied that they had so much to do in the beginning with the ordinary tramway carriages that they thought it was well to stick to that which they knew something about. Later, competition became so great in the various departments that they really did not see their way to invest any more of their capital in railway wagon works. They had powerful competitors, and they thought it was just as well to devote attention to tramway and omnibus work, for which they originally laid out the works. With regard to the Hadley and Trafford Park Works, they had tried to dispose of them, but trade had been so bad they had had no offer equal to their expectations. They hoped as soon as trade improved to dispose of them.

The report was adopted.

Underground Electric Railways Co., Ltd.

The half-yearly meeting of this company was held on Tuesday at Hamilton House, Victoria Embankment, Sir Edgar Speyer presiding.

In moving the adoption of the report (see Electrical Review, September 3rd, 1909), the Chairman said he was pleased to be able to record a period of continued progress and to express unqualified satisfaction at the results attained. Turning to the balance-sheet, the temporary loans, which stood at £225,000 on the debit side of the balance-sheet, would be paid off on October 1st next, and the redemption of the 4½ per cent. power house second debentures would be effected by the sale and issue of £1,000,000 4½

per cent. first debentures. Thus they would be free of a floating debt, and would have a good cash balance. The net revenue for the half-year was insufficient by £16,240, to meet the half-yearly charges. They would remember, however, it was estimated when the scheme was published that there would be a deficit for the year 1909 of £96,000. The result was, therefore, distinctly encouraging. If they compared the figures one by one with the first issued accounts, it would appear that the deficit was increasing, but that was accounted for by the fact of their holding with the tube railways and that part of the fixed charges were charged to capital under the scheme of re-adjustment. The accounts, taken altogether, showed a healthy increase and reduced working costs. In that connection, the directors were appreciative of their general manager, Mr. Stanley. The result of the tramways had again been unsatisfactory, but as that company published their accounts yearly, he would reserve his observations on that point until the next meeting. He thought, from the various expressions of opinions he had received, that the directors' policy of publishing a monthly statement of net earnings of the associated companies was appreciated by the investing public. That would be the last meeting they would hold in that building, as the company had taken a set of rooms at the St. James' Station of the District Railway, which he thought would not only result in a considerable saving of rent, but also of time.

The Right Hon. Lord George Hamilton seconded the motion, and the report was adopted without discussion.

Yorkshire Electric Power Co., Ltd.

The directors' report for the half-year to June 30th, 1909, states that the receipts from the sale of energy and for work charged out to consumers, &c., for the half-year ending June 30th last amount to £11,169, against for the half-year ending June 30th, 1908, £8,698, and for the half-year ending June 30th, 1907, £4,700. The gross profit on the revenue account for the half-year is £2,598, against a gross profit for the half-year ending June 30th, 1908, of £1,249, and a gross loss for the half-year ending June 30th, 1907, of £403. After payment of mortgage interest the net revenue account shows a profit on the half-year just ended of £1,069, compared with a profit for the corresponding half-year in 1908 of £363, and a loss for the half-year ending June 30th, 1907, of £1,211. The demand for energy per horse-power connected has been low owing to the depressed state of nearly all the industries in the company's area; notwithstanding the adverse conditions of trade, there has been a steady increase in the use of the company's supply.

Mr. A. G. Lupton presided at the half-yearly meeting held at Leeds on Tuesday. He said that the company was making steady advance. According to the *Financial News*, he said that the mains on which the capital had been spent were only beginning to bring in revenue during the past half-year. The textile industries continued to bring in the largest revenue, but the colliery load was also increasing satisfactorily. The company's meter readings confirmed what had been said of the revival of trade, and the increased output has been the result of new business. Consumers in undeveloped portions of the district were pressing for the mains to be extended to them, and the directors had decided, in the first place, to meet the urgent demand from the Castleford district. In consequence of increased demand, a boiler of a capacity of 50 per cent. greater than the boilers originally installed had been put down, and it had been decided to install a fourth turbine of a capacity equal to any two of those at present in the station. Those extensions would entail the provision of further capital. The whole of the borrowing powers had been exhausted. Under the powers of the company's Act, further capital could only be obtained by the issue of ordinary shares at par value. That was not at present practicable, and it would be necessary to amend the company's Act by applying to Parliament for further powers to authorise the issue of preference stock. The directors considered it advisable to ask for other powers which had been granted to later-formed companies, which would much facilitate the work of the company.

Mr. T. O. Callender seconded, and the report was adopted.

Prospectus. — "*Thorium*" (*Metal-Filament*) *Lamp Works, Ltd.*—A prospectus is in circulation offering for subscription until Monday next, September 27th, 11,000 7 per cent. cumulative preference shares in this company. The nominal capital is £30,000 in 11,000 preference and 19,000 ordinary shares of £1 each. The company will acquire the Britannia Electric Lamp Works at South Tottenham, together with patent and license rights for the "Thorium" and "Reflex" lamps, also plant and machinery and contracts, from the Merchants' Trading Co., Ltd., the vendors, for £20,000, paid as to £1,000 in cash, and the remainder in ordinary shares. The £10,000 preference capital, which the public are desired to apply for, will be set aside for working capital and general purposes. The works are sufficient for the manufacture of 300,000 lamps per annum. A contract has been entered into with "a leading house in the wholesale electric lamp trade" for the purchase of up to 250,000 "Thorium" lamps per annum for two years.

Rio de Janeiro Tramway, Light and Power Co.—A dividend of 1 per cent. is announced.

Dick, Kerr & Co., Ltd.—The directors' report of the trading for the 12 months ended June 30th, 1909, states that the profits earned during the 12 months' trading to June 30th, 1909, amount to £28,168. Out of this has had to be paid debenture interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £12,693, leaving a balance of £15,475, to which must be added the profits brought forward from last year—viz., £81,567, making a total of £97,041 available for appropriation as under:—Dividend of 6 per cent. per annum on the preference share capital (the proportion of this dividend to December 31st, 1908, has already been paid), £18 300; dividend of 6 per cent. on the ordinary share capital of £260,000, to be paid less income-tax, £15,600; to carry forward £63,141. The dividend on the preference shares will be paid on October 1st, 1909, as usual, and the dividend recommended on the ordinary shares will be paid on same date if approved by the shareholders. The directors regret that the severe competition referred to in the last annual report has continued throughout the past year in a more acute form. In addition, the quantity of work carried out in all departments has been considerably below the average.

Demerara Electric Co.—Gross earnings for the seven months ended July are $74,929; for the same period in the previous year they were $68,952. Net earnings for the same period totalled $34,155, in comparison with $25,940 last year.

British Electromobile Co., Ltd.—A financial paper states that the report of this company states that the accounts for the period to March 31st show an adverse balance of £204.

Halifax and Bermudas Cable Co., Ltd. — The directors' report for the year ended June 30th, 1909, which was presented at the meeting held on 16th inst., showed that the net result of the year's working was an available balance of £3,313, as compared with £3,096 for the previous year. An interim dividend of 2½ per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £813 to be carried forward. Opportunity was taken of a cable ship being in the vicinity of Bermuda to engage her to thoroughly overhaul and renew where necessary the harbour cable and the shore end of the main section at the cost of £817. The balance to credit of revenue account, which was last year increased to £18,444, has been debited with £1,250 applied to dividend, and with £817 expended in renewals during the year, and credited with £813, surplus revenue of the past year, and it now stands at £17,189. The company's cable has worked efficiently. During the year debentures have been paid off to the amount of £9,600, leaving £10,000 outstanding. Mr. Charles R. Hosmer has resigned his seat at the board.

United River Plate Telephone Co., Ltd.—An issue of 30,000 ordinary shares of £5 each has been offered to holders of ordinary shares in the proportion of one new share for every four held. The latest price of this new issue is 1⅛ to 1¼ premium.

Folkestone Electricity Supply Co., Ltd. — The directors have declared an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the past half-year.

Direct West India Cable Co., Ltd.—The annual report for the year ended June 30th, 1909, which was presented at the meeting held on September 16th, states that the net result of the year's working was an available balance of £5,190, as compared with £6,150 for the previous year. An interim dividend of 3 per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £3,390 to be carried forward. The hurricane of September last year did very serious damage to the company's cable property, and the necessary repairs and renewals, together with work at Bermuda, involved an outlay of £3,821. The balance to credit of revenue account, which was last year increased to £34,397, has been debited with £900 applied to dividend, and with £3,821 expended in renewals and repairs during the year, and credited with £3,390 surplus revenue of the past year, and it now stands at £33,065. The company's cables have worked efficiently. A licence to establish, install and work a wireless coast station was granted to the company by the Jamaica Government on February 16th last, and the cost to date has been taken to capital expenditure. During the year debentures have been paid off to the amount of £7,400, leaving £43,500 outstanding. Mr. Charles R. Hosmer resigns his seat at the board.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the half-year ended June 30th last, payable on October 15th next.

Stock Exchange Notice.—Application has been made to the Committee to allow the following security to be quoted in the Official List:—British Aluminium Co.—Further issue of £175,600 5 per cent. mortgage debenture stock.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended August 27th, 1909, were 735,625, compared with 615,469 units in the corresponding four weeks of 1908.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 15	2,884	+ 42	15	28,832	— 558	..	..
Ayr	„ 18	1,002	+ 137	18	7,601	— 55	8	..
Bath	„ 15	1,762	+ 102	37	29,062	+ 1,402	..	..
Belfast	„ 17	7,573	+ 265	23	94,009	+ 4,092	37	..
Birkenhead	„ 19	2,186	— 30	24	26,686	— 405	13·5	..
Birmingham Corp.	„ 11	12,748	— 59	24	154,442	+ 3,786	34	..
Blackburn	„ 15	2,340	+ 102	24½	28,303	— 907	13·97	..
Blackpool-Fleetw'd	„ 18	2,717	+ 467	11	17,204	+ 1,094	..	..
Bolton	„ 5	4,638	+ 215	23	54,298	— 175	26	..
Bournemouth	„ 15	4,016	+ 1	24	44,478	+ 266	21·96	..
Bradford	„ 12	7,465	+ 561	24	56,797	— 287	54·10	..
Brighton	„ 19	2,281	+ 189	25	26,704	+ 1,299	9·5	..
Bristol	„ 17	11,318	+ 794	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 10	460	+ 25	36	7,870	— 75	3·65	..
Barnsley	„ 10	349	+ 6	„	6,095	— 310	..	..
Barrow	„ 10	531	+ 1	„	8,427	— 603	5·37	..
Cavehill	„ 10	182	+ 17	„	2,341	120	..	..
Devonport	„ 10	767	— 228	„	13,364	— 3,298	8·85	..
Gateshead	„ 10	1,984	— 39	„	35,869	— 335	11·25	..
Gravesend	„ 10	483	+ 22	„	7,613	— 117	6·5	..
Greenock	„ 10	1,582	+ 231	„	20,012	+ 756	7·25	..
Hartlepool	„ 10	530	+ 11	„	8,547	— 212	6·72	..
Kidderminster	„ 10	261	+ 21	„	4,015	— 195	..	..
Leamington	„ 10	413	+ 48	„	6,301	+ 230	..	..
Merthyr	„ 10	441	— 8	„	7,761	+ 95	2·9	..
Metropolitan	„ 10	13,982	+ 1,218	„	221,760	+ 17,753	23	..
Middleton	„ 10	799	+ 25	„	12,327	— 924	8·5	..
Mid. Joint Com'tee	„ 10	11,635	+ 74	„	205,324	— 2,197	..	..
Oldham—Ashton	„ 10	1,909	— 29	„	20,315	— 1,247	9·18	..
Peterborough	„ 10	252	— 15	„	40,294	— 345	5·31	..
Potteries	„ 10	3,720	+ 78	„	64,795	— 1,207	29	..
Rothesay	„ 10	652	+ 127	„	8 692	— 8	2·75	..
Southport	„ 10	696	+ 27	„	10,771	— 284	8·17	..
S. Metropolitan	„ 10	1,790	+ 71	„	29,018	— 828	..	..
Swansea	„ 10	2,101	+ 142	„	34,935	+ 727	12·5	..
Tynemouth	„ 10	602	+ 167	„	9,422	+ 731	3·75	..
Weston-s-Mare	„ 10	683	+ 100	„	6,168	+ 864	3	..
‡Worcester	„ 10	640	— 81	„	10,195	— 101	5·75	..
Wrexham	„ 10	224	+ 2	„	3,560	— 147	..	..
Yorks. Wool. Dist.	„ 10	1,975	+ 183	„	32 885	— 201	17	..
Miscellaneous	„ 10	482	+ 35	„	7,687	— 119	..	..
Burnley	„ 18	2,704	+ 263	..	..	..	..	..
Burton-on-Trent	„ 19	630	— 7	25	6,789	— 177	6·63	..
†Bury	„ 19	1,966	— 7	24½	29,786	— 487	22·5	..
†Cardiff	„ 11	2,180	— 83	24	53,979	+ 446	..	..
Carlisle	„ 18	648	— 19	27	6,207	— 265	..	..
Chatham and Dist.	„ 16	1,827	+ 51	37	30,527	+ 1,740	15	..
Cork	„ 16	1,015	+ 76	37	16,496	— 690	9·69	..
†Croydon	„ 3	1,714	+ 433	..	35,098	+ 1,682	11·25	4·75
†Darlington	„ 18	178	— 28	25	4,674	— 842	..	..
Darwen	„ 18	589	+ 22	24	6,193	— 206	4·36	..
Dover	„ 11	518	+ 7	24	5,510	— 378	4·75	..
Dublin	„ 17	10,683	— 155	..	67,312	+ 1,001	54·25	..
Dundee	„ 15	2,604	— 99	17½	21,804	— 514	15	..
East Ham	„ 18	2,012	+ 223	24½	25,132	+ 3,488	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	„ 18	85,448	+ 893	..	966,015	— 2,756	94½	5
Hastings	„ 16	2,814	+ 12	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
†Hull	Aug. 28	2,571	+ 214	21	51,383	+ 1,483	14·5	1·5
Ilkeston	Sept. 16	271	— 19	24	3,340	— 213	..	..
Ipswich	„ 18	936	+ 20	25	10,722	+ 175	10·6	..
†Kilmarnock	„ 11	146	— 3	17	2,622	— 91	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	„ 15	2,799	+ 115	37	49,876	— 465	..	..
Leeds	„ 11	13,772	+ 869	24	163,811	+ 8,376	54	6
Leicester	„ 18	4,418	+ 94	..	..	..	..	..
Leith	„ 11	1,256	+ 244	17½	11,146	+ 1,435	9	3
Liverpool	„ 11	21,760	+ 227	36½	389,154	— 2,149	58·5	..
‡L.C.C.	„ 4	75,411	+ 4,648	..	820,987	+ 31,848	90	4·25
London United	„ 18	18,014	— 2,075	..	229,700	— 22,864	..	..
†Lowestoft	„ 11	331	— 6	30	9,313	— 1,041	3·5	..
†Manchester	„ 18	14,862	— 178	25	373,599	— 2,907	105	..
Newcastle	„ 18	7,415	— 229	..	95,605	— 1,890	..	..
†Newport	„ 18	634	— 22	25	16,700	— 336	14·5	..
†Oldham	„ 19	1,880	— 49	25	48,106	— 3,452	28·75	..
†Pontypridd	„ 4	394	— 28	22½	9,549	+ 1,094	5·5	1·75
Portsmouth	„ 18	4,720	+ 197	25	56,551	1,796	15·25	·75
†Preston	„ 8	733	+ 19	..	..	..	..	..
Rotherham	„ 16	1,146	— 94	24½	14,431	— 695	10	·66
Salford	„ 13	9,139	+ 189	23½	110,804	— 3,833	..	..
Sheffield	„ 21	11,190	+ 289	25½	142,948	— 949	39·62	2·6
Southampton	„ 15	2,300	+ 58	24	26,948	— 388	..	..
Southend-on-Sea	„ 15	1,345	+ 115	24	14,998	+ 2,229	..	..
†South Shields	„ 11	560	+ 2	23½	13,797	+ 8	..	..
†Swindon	„ 1	154	— 3	..	..	..	..	..
Tyneside	„ 15	849	+ 63	11	5,116	+ 284	..	..
Wallasey	„ 18	1,927	— 22	24½	23,945	+ 956	..	·22
Walthamstow	„ 18	1,319	+ 11	25	17,302	+ 344	9	..
†West Ham	„ 9	4,320	+ 410	23½	55,496	+ 3,492	15·13	·48
Wolverhampton	„ 16	1,657	+ 90	24	19,778	— 860	13·5	..
Baker St.-Waterloo	„ 18	5 815	— 285	11	31 810	+ 160	4·25	..
Cen. London Rly.	„ 18	10,007	— 6,569	11	54,206	— 25,134	6 22	·55
Cheshire Lines, Manch.	„ 18	7,220	+ 170	11	39,920	+ 4,470	7.75	..
City & S. Lon. Rly.	„ 19	6 218	+ 50	11	33,539	+ 1,220	7·3	..
Dublin-Lucan Rly.	„ 17	292	— 8	11	1,852	+ 39	7	..
G.N. and City Rly.	„ 18	2 611	+ 10	11	13,739	— 38	3·5	..
G.N., P'y. & Brmtn.	„ 18	10,065	— 160	11	53,725	+ 490	9·25	..
L'pool Overh'd Rly.	„ 19	2 893	+ 82	..	17,680	+ 172	6·8	4·8
†Llandudno-Col. Bay	„ 10	698	+ 141	41	11,982	+ 2,048	..	..
Mersey Railway	„ 18	8,257	+ 84	11	21,003	+ 770	4·5	..
Metropolitan Rly.	„ 19	31 598	— 2,186	..	172,901	— 521	24·5	..
Met. District Rly.	„ 18	18,810	— 156	11	103,003	+ 5,344	14	..
Anglo-Argentine	„ 16	79,659	— 4,998	..	1,442,968	+ 88,925	..	..
§Auckland	Aug. 13	13,100	— 2,471	..	109,614	+ 10,835	22·3	1·38
Bombay (B.E.T.)	„	5,186	+ 625	53	82,650	+ 5,086	..	..
§Brisbane	..	..	..	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 18	6,917	+ 449	..	..	..	..	..
§Cape Electric T. Ltd.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	..	..	..	..	..	..	..	..
Madras	„ 15	122	+ 32	..	2,167	+ 504	..	..
§Melbourne	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	„ 17	2,635	+ 134	..	51,899	+ 376	28	2·22

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Taken on the whole, the past week has not been a very exciting one for the Stock Exchange, and the majority of markets have presented a very idle appearance. An exception to this, however, has been the rubber division, where a large business has been done at improving prices. Most of the new issues have been well applied for by the public, but the cautious investor refuses to budge from the old-established concerns.

Business in the Home Railway market has been at a very low ebb, and the smallest transaction has been quite sufficient to move prices. Owing to the coal strike news being better, things generally are harder in tone, but that is about as much as one can say. Metropolitan Consolidated moved up ¼ to 38¼-9, but Districts fell to the same extent to 15⅝-16¼.

The Canadian group of Tramway, Light and Power concerns has been the subject of some newspaper criticism during the past week, and prices in consequence have fluctuated rather more than usual. Mexico Tramways close a little off the top at 127 to 128, and Rio Tramways fell from 95½ to 94 on the announcement of the company's first dividend of 1 per cent. Mexican Light and Power and Common shares shot up smartly to 72-3, after changing hands as low as 68, but quickly fell back to 68¼-69¼. The returns for August show a very serious falling off as compared with the previous 12 months. Sao Paulo Tramways were wanted, and rose a point to 149 151. Monterey Debenture still keeps firm at 88½ to 89½, whilst Brazil Rails at 50 to 51 are as hard as nails. Bahia Tramway Common are no better than 11 to 12, and it is almost impossible to deal in the 5 per cent. Gold bonds, which are quoted nominally 61 to 63 per cent.

Strong buying of British Columbia issues has caused a sharp spurt in prices, and the market is none too flush of stock at the moment. The new shares have hardened in sympathy, the quotations for "delivery" now being Preference 3d. dis.—3d. prem.; Preferred Ordinary 6d.—1s. 6d. prem.; Deferred Ordinary 4s. 9d.—5s. 9d. prem. over the issue price.

Anglo-Argentine Tramway descriptions were put down a fraction on the announcement that the Chamber had adopted a Bill authorising the construction of an underground electric railway running across the city from east to west. It is understood in the market, however, that the tramways have nothing to fear in the way of competition. British Electic Traction issues are lifeless, and quotations show no movement.

Trading amongst telegraph and cable companies has been very steady with a strong demand for the lower priced shares. The feature has been the further rise in Anglo-American Deferred on expectations of an increased dividend. The Ordinary stock has also improved ½ per cent. to 62—63. West Coast of America shares are higher to the extent of ⅛ to 1⅛—⅛, and West India and Panama issues have enjoyed an all-round advance.

Not quite so much has been doing in the iron and steel division, and prices, through being neglected, have sagged a little all along the line.

The Electricity Supply division presents a firm front, and, if anything, rather more business has been passing in the favourite stocks. Charing Cross Preference were marked up ⅛ to 4 9/16—4 11/16, and County Preferences were bought for investment purposes, and finished ⅛ better at 10⅞—11. Kensingtons were in demand, and rose ⅛ to 6⅞—7⅛. St. James improved ⅛ to 8⅝—9⅛, but Urban Preferences were put down ⅛ in the Official List to 1⅜—1⅞. South Metropolitan Light and Power Preferences were a shade easier at 1 1/16—1 3/16.

Johnson-Lundell Electric Traction Co., Ltd.—The report for the thirteen months to June 30th last, to be submitted to the meeting on the 28th inst., states (as published in the *Financial Times*) that the sale of the works at Southall, as reported at the last meeting, was duly completed and the purchase price paid. The operations of the year have been limited to carrying forward certain improvements in the apparatus connected with the company's regenerative system and to maintaining the patents. The efforts of the board to make a sale of the patents at a satisfactory price have not yet been successful. In the course of the current year it is hoped that something in this direction may be accomplished, or that a proposal to reorganise the company may be submitted for the shareholders' consideration. Messrs. J. H. Holmes and Co. have transferred in terms of their undertaking the whole of the paid up shares held by them. The present meeting is convened to comply with the requirements of the Companies' Acts. The directors, owing to the chairman's absence abroad, propose that the meeting be of a formal character only, and that it be adjourned *sine die* without doing any business. The directors have waived their fees in respect of the period now under review.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Sept. 14th.	Closing Quotations Sept. 21st.	Business done week ended Sept. 21st, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ — 3⅜	2⅞ — 3⅜	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$131,561,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	145 —147	146 —148	147⅞	146⅜	+1	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	97 — 99	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	61 — 63	61½ — 63½	..	..	+ ½	5 2 3
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	104 —105	105	104½	..	5 14 3
3,220,770	Do. do. do. Deferred	Stock	½%	1⅝%	1 %	8/-	21½ — 21¾	22 — 21½	22 7/16	21 5/16	+ ⅜	1 16 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,431,350	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	91	..	..	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼ — 9½	8¼ — 9½	9	8 1/8	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17¼ — 18½	..	..	+ ½	6 9 7
12,231	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 15 11
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼ — 8⅝	8⅛ — 8⅝	..	..	+ ⅛	5 14 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100½ —102½	..	..	+ ⅛	2 3 11
60,710	Direct United States Cable	20	4½%	4⅝%	4½%	4½%	13 — 13¼	13⅛ — 13⅜	13⅜	13 1/16	+1/16	6 4 9
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, £.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —132	129 —132	131	129½	..	5 6 10
2,000,000	Do. 5½ % Pref. Stock..	100	5½%	5½%	5½%	5½%	84½ — 86½	85 — 87	86	85	+ ½	4 0 6
1,596,706	Do. do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½	104½ —106½	105½	..	..	3 15 2
300,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅞ — 12⅛	11⅞ — 12⅛	12⅛	11 1/8	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
300,000†	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅞%	5⅞%	10½ — 10⅝	10½ — 10⅝	10⅝	10⅜	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13¾ — 14¼	13⅞ — 14¼	14 1/16	..	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	26 11/16	26½	..	5 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	12 %	12 %	12 %	12 %	51½ — 53½	51½ — 53½	53½	53	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	82 — 86	89 — 92	90	..	+6½	4 7 0
$30,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	77 — 80	..	..	+2½	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3/4 — 7/8	¾ — ⅞	16/6	15/6	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	..	..	..	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 —107½	107	106½	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	121¾	121½	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	10⅝	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5 1/8	5 1/16 — 5 1/8	5 3/16	5 1/16	..	4 7 3
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 18 5
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅛ — 1 5/16	1⅛ — 1 5/16	31/3	29/4½	+ 1/16	5 5 9
50,000	Do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 15 3
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87	86½	..	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839†	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8¼	7⅞ — 8¼	7⅞	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	130 —133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅜ — 7	6⅜ — 6⅝	6 15/16	6⅜	— ⅜	6 0 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5½ — 5⅝	5½ — 5⅝	..	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1½ — 1⅝	1⅜ — 1⅝	30/-	27/6	+ ⅛	3 16 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13½ — 13⅝	13⅝ — 13⅝	13 9/16	..	..	5 1 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	14/9	11/4½	+ 1/16	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8⅜ — 8⅝	8¼ — 9	8 1/16	..	+ ⅛	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8½ — 9½	..	..	+ 1/16	15 15 10
80,000†	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101½ —103½	..	..	+ ½	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅜ — 4⅝	4⅜ — 4⅝	96/3	93/9	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4 1/16 — 4 1/8	4¼ — 4⅜	91/3	..	—1/16	5 17 8
978,220	Do. 4 % Deb. Stock	..	..	..	..	4 %	93½ — 93⅝	93⅜ — 93½	98⅛	92⅝	..	4 6 6
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	102½	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	4⅜ — 4⅝	4⅜ — 4⅝	93/9	90/7½	— ⅛	4 6 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2 — 2⅛	2 — 2⅛	15/-	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅛ — 2⅜	2⅛ — 2⅜	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	6 %	3⅜ — 3⅝	3⅜ — 3⅝	70/-	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¾ — 3¼	2¾ — 3¼	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	95 — 98	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —147	144 —149	146	..	+2	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	114 —119	117 —122	120¾	117½	..	5 0 1
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —109	106 —110	108	106½	+1	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	8 %	Nil	Nil	Nil	1/16 — 1/8	⅛ — ⅞	12/6	11/8	—1/16	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2 — 2¼	2 — 2¼	43/9	40/-	..	6 0 0
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	85¾	85½	..	5 14 11
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	63 — 67	..	..	..	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅛ — 7⅜	7⅛ — 7⅜	7 13/16	..	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6⅜	6⅛ — 6⅜	6⅜	..	..	4 11 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940†	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
1,916,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	40	30½	..	9 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16 — 9/16	7/16 — 9/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000†	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	44 — 46	41 — 46	..	..	..	9 15
125,000†	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	4½%	4⅜ — 5½	4⅜ — 5½	97/6	..	..	4 5 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4⅜ — 6	4⅜ — 5	96/-	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜ — 11⅛	10⅜ — 11⅛	10 1/8	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2¼	2 — 2¼	41/3	41/-	..	5 17 8
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —108	106 —109	106½	..	+1	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	62 — 64	61 — 63	62	..	—1	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	44⅞	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1½%	2½%	2½%	1½%	31 — 32	31 — 32	31⅛	31	— ⅛	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	⅞ — 1⅛	⅞ — 1⅛	..	..	..	13 6 8
100,000†	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Sept. 14th.	Closing Quotations Sept. 21st.	Business done week ended Sept. 21st, 1909. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
200,000	Dick, Kerr & Co., 1 to 200,000	1	10 %	10 %	10 %	10 %	1¼ – 1⅝	1 – 1¼	20/-	..	..	8 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1⅝ – 1¾	⅞ – 1⅛	..	..	..	4 14 1
271,030	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	100 –103	100 –103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅞ – 13⅜	12⅝ – 13⅛	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	4½ %	2½ %	1½ %	1/16 – 1/8	1/16 – 1/8	..	..	..	24 0 0
17,189	Do. "A" shares, 01—017,189	5	4½ %	4½ %	2½ %	2½ %	⅛ – 1⅛	⅛ – 1⅛	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	69 – 73	68 – 73	..	..	..	5 9 7
67,730	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 – 87	84 – 87	..	..	..	5 13 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 – 1/8	1/16 – 1/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅛ – 1⅜	1⅛ – 1⅜	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞ – 8¼	7⅞ – 8¼	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 – 88	85 – 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	⅛ %	Nil	½ – 1	½ – 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ – 10⅞	10½ – 10⅞	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 –103	102 –103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12⅜ – 13⅜	12½ – 13½	13	12½	..	5 12 2
40,000	Do. do. Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅛ – 5⅜	5⅛ – 5⅜	5⅜	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105 – 107½	106 –108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	10 %	14½ – 15½	14⅜ – 15½	15⅜	15⅛	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛ %	Nil	3/16 – ¼	3/16 – ¼	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ – 4¾	4½ – 4¾	..	..	..	10 10
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1⅛ – 2½	1⅛ – 2½	..	..	..	Nil
599,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛ – 2½	1⅛ – 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜ %	2⅛ – 2⅜	2⅛ – 2⅜	48/9	..	+ ⅛	13 12 8
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	..	4 %	67 – 70	67 – 70	67⅜	..	..	5 14 4
5,789,062	Metropolitan Consolidated	100	2⅜ %	1 %	⅛ %	⅛ %	37⅜ – 38½	39½ – 39⅝	39⅜	37⅞	+ 1⅛	1 5 2
2,640,914	Do. Surplus Lands	100	2⅜ %	2⅜ %	2⅜ %	2⅜ %	65 – 67	65 – 67	..	..	..	4 2 1
8,295,000	Do. District	100	Nil	Nil	Nil	Nil	16 – 16⅛	16 – 16⅛	16 7/16	15 13/16	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	44%	1⅜ – 1⅝	1⅜ – 1⅝	15/-	10/-	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	⅜ – ½	⅜ – ½	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1⅛ – 1⅜	1⅛ – 1⅜	15/7½	14/6	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	94 – 96	94½ – 96½	96	94	+ ½	4 13 3
10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 –128	126½ –129½	129⅜	125⅞	+ 1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	90 – 92	91 – 93	93	10	+1	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ – ¼	⅛ – ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ – ¼	⅛ – ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	86 – 89	86 – 89	..	..	..	5 1 2
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½ %	15 %	34½ – 36	34½ – 36	34½	..	..	5 0 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 –102	100½ –102½	..	..	+ ½	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½ –103½	102½ –103½	103	102⅝	..	4 16 7
2,800,000	Do. do. 4½ % Bonds	..	..	..	..	4½ %	88 – 90	88 – 90	90	88⅜	..	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	36 – 38	36 – 38	37⅛	36	..	..
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜ – ½	⅜ – ½	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 30,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	2⅜ – 3¼	2⅜ – 3¼	58/9	52/6	..	1 18 5
245,495	Do. % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	4 %	78 – 82	78 – 82	79½	79	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	..	5½%	5½%	5½%	5½%	4½ – 4⅝	4½ – 4⅝	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 – 96	93 – 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,000	5	10 %	10%	10 %	10 %	7⅞ – 7⅞	7½ – 7⅝	..	..	— ⅛	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅛ – 8	7⅛ – 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 –100	97 –100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 – 4½	4 – 4½	82/6	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ – 4½	4½ – 5	..	..	+ ⅛	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8¾ – 4⅜	9¾ – 4⅜	85/-	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 – 99	96 – 99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3¾ – 4	3¾ – 4	..	..	..	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 –103	100 –103	101½	..	..	4 7 6
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ – 10⅞	10⅜ – 10⅞	10⅝	10 7/16	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ – 12½	11½ – 12½	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 –124	121 –124	124	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 –103	100 –103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½ – 2	1½ – 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 – 3½	3 – 3½	..	..	..	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ – 95½	93½ – 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ – 8⅛	7⅜ – 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ – 11	10⅜ – 11⅛	11	10½	+ ⅛	5 7 10
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 –107	104 –107	..	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 –103	100 –103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 – ¼	3/16 – ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅜ – ½	⅜ – ½	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 – 61	58 – 61	..	..	..	7 7 7
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	84 – 86	84 – 86	85½	..	..	5 16 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ – 5	4½ – 5	90/-	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 – 5¼	5 – 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 –100	97 –100	..	..	..	4 10 0
15,000	Howe, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞ – 7⅞	7⅞ – 7⅞	..	..	..	5 11 6
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 –101	99 –101	100½	99½	+ ½	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6¾ – 7	6⅞ – 7⅛	..	..	+ ¼	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 – 98	95 – 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ – 2⅛	1⅞ – 2⅛	37/6	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 – 5½	5 – 5½	5	..	..	5 17 1
282,255	Do. do. 4 % 1st Mort. Deb. Red.	Stock	4 %	4 %	4 %	4 %	93 – 97	93 – 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅛ – 4⅜	4 – 4⅛	87/6	82/6	— ⅛	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ – 5	4⅜ – 5	..	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 –108	105 –108	..	..	..	4 3 4
248,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	5½%	83½ – 86½	83½ – 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 – 82	79 – 81	80½	80½	—1	6 3 5
13,685,000	Do. Light and Powe Co Ltd., Common	$100	..	..	..	3½%	66 – 70	67 – 71	72	68½	+1	4 18 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	100 –104	102 –106	106	100½	+2	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	82 – 84	83 – 85	84½	81½	+1	5 17 8
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 – 99	96 – 99	..	..	..	4 10 4
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅛ – 4⅜	4⅛ – 4⅜	..	..	..	2 14 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅛ – 5⅛	4⅜ – 5⅛	..	..	..	4 15 3
126,500	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265}	100	..	..	..	..	99 –101	99 –101	..	..	..	..
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12 – 13	12 – 13	..	..	..	5 7 8
20,000	Oxford, 1 to 90 and 407 to 20,310	5	7 %	7 %	7 %	..	6 – 6⅛	6 – 6⅛	..	..	..	5 7 8
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 – 98	95 – 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	2 %	2 %	1/16 – 1/8	1/16 – 1/8	..	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	⅛ – ¼	⅛ – ¼	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 –106	103 –106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾ – 9	8⅞ – 9⅛	8 15/16	8⅝	+ ⅛	6 7 0
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 – 7⅛	7 – 7⅛	..	..	..	4 11 10
150,000	Do. do. 5½ % Deb. Stock Red.	100	5 %	5½%	5½%	5½%	84 – 88	84 – 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	3/16 – ¼	3/16 – ¼	..	..	— 1/16	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜ – 3	2⅜ – 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 – 1/8	1/16 – 1/8	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ – 1¼	1 1/16 – 1 1/16	21/8	..	— 1/16	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 –105	102 –105	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ – 1	¾ – 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ – 2	1⅝ – 1⅞	33/-	..	— ⅛	18 8 8
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 – 81	77 – 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	27/32 – 29/32	27/32 – 29/32	18/-	..	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8¾ – 9	8⅞ – 9	8⅞	8 5/8	..	5 11 1
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 – 5⅛	5 – 5⅛	5 1/8	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st. 1909.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1909.

The August export returns, although, of course, not up to the exceptionally high total of July, which included a large telegraphic export, are well above the average of previous months. The exports amounted in total to £302,849, and for comparison, deducting telegraphic exports, we have £257,534 remaining as general business, as compared with £246,663 in July, £250,000 in June, &c.

As regards the imports, these amounted to £130,678, as compared with £161,190 in July; the total being under the average of the previous seven months of the year; the re-exports show an improvement, totalling £15,591, as compared with £12,577 in the previous month.

Of the individual items of the exports, electrical machinery shows an increase in value, although other items, such as telephonic and telegraphic material—particularly the latter—are considerably below the July values.

The import items show general reductions all round, and do not call for special comment.

Japan, India, the U.S.A., Canada and the Argentine figured as prominent purchasers, while the importing countries remained much as in previous months.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	144	4,665	195	81	84	3,380	50	78	...	15	85	8,777
Germany	228	237	5	60	30	242	...	9	...	70	...	881
Netherlands and Java	275	1,747	2	...	5	479	...	2	...	15	95	2,620
Belgium	65	298	63	...	317	865	20	...	...	397	296	2,321
France and French Indo-China	270	...	158	227	...	439	...	92	...	8	...	1,194
Switzerland	2	...	...	...	6	542	...	...	...	...	...	550
Portugal, Azores, Madeira, Portuguese Africa and India	97	579	16	110	71	165	95	...	...	4	224	1,361
Spain, Canary Isles and Morocco	42	56	...	144	110	899	505	...	...	...	73	1,829
Italy and Austria-Hungary	48	22	72	...	1,367	5,130	700	...	23	630	1,815	9,507
Greece, Bulgaria and Turkey	23	13	22	30	18	286	...	187	...	...	26	605
Channel Isles, Gibraltar and Malta	90	288	11	...	52	472	...	85	...	52	11,319	12,369
U.S.A.	90	...	8	...	307	26,009	52	8	106	...	841	27,421
Canada and Newfoundland	606	874	1,038	145	1,390	1,477	1,388	46	...	1,889	11,189	20,042
Bahamas, British Honduras, British West Indies and British Guiana	136	...	47	25	84	159	...	131	...	56	20	658
Mexico, Venezuela and Bolivia	621	...	12	112	...	51	...	3	...	...	...	799
Peru and Uruguay	11	...	...	...	14	752	...	...	...	500	10,928	12,205
Chile	...	30	22	1,184	113	2,125	50	24	...	59	19	3,626
Brazil	329	763	175	484	282	5,435	...	44	10	8	2,822	10,352
Argentine	647	2,291	88	942	2,015	9,778	3,492	382	150	2,364	967	23,116
Egypt and Tunis...	22	176	101	199	38	97	16	46	20	110	...	825
British West Africa and St. Helena ...	39	56	36	61	...	278	...	2	...	159	83	714
Cape of Good Hope	369	1,818	75	163	325	2,556	596	498	25	9	34	6,468
Natal	1,094	4,864	80	339	20	3,831	...	...	37	...	...	10,265
Rhodesia, Orange River Colony and Transvaal	1,340	2,577	461	1,131	84	2,342	...	59	7	43	10	8,054
Zanzibar, Brit. East Africa and Mauritius ...	14	61	19	38	40	33	...	21	...	62	232	520
China and Siam	1,728	133	228	153	234	243	58	401	...	328	1,060	4,566
Japan and Korea	3,331	8,692	384	22	1,759	21,214	3,280	16	151	1,723	1,196	41,768
India	1,336	5,144	1,511	2,148	855	11,383	7,232	497	151	40	469	30,766
Ceylon	59	217	...	41	...	20	...	...	...	39	12	388
Straits Settlements and Fed. Malay States ...	53	596	236	20	33	192	40	58	78	59	32	1,197
Hong Kong	152	464	4	256	...	242	67	...	...	10	66	1,261
West Australia	418	...	...	51	148	520	40	3	...	10	139	1,329
South Australia	152	150	47	101	19	3,383	937	88	...	397	...	5,274
Victoria	443	4,283	...	961	756	1,645	...	146	...	2,416	723	11,373
New South Wales	1,830	710	376	...	764	9,504	170	187	...	41	...	13,582
Queensland	28	...	26	88	...	1,596	...	26	97	2,474	...	4,335
Tasmania	...	...	...	...	...	...	...	616	...	129	...	745
New Zealand	631	5,261	445	269	274	7,583	1,135	312	8	2,238	540	18,686
Total, £	16,753	47,065	5,963	9,585	11,614	125,347	19,923	4,067	863	16,354	45,315	302,849

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	...	18	...	28	23	1,160	...	239	...	3,024	4,492
Germany	579	10,372	1,356	20,272	2,246	25,264	817	761	3,781	7,873	73,321
Holland	24	4	4	1,945	5	53	...	...	134	324	2,493
Belgium	159	1,272	215	192	51	1,407	...	82	337	8,979	12,694
France	641	...	545	1,228	1,152	135	29	1,035	2,593	4,824	12,182
Switzerland	182	...	12	20	64	201	2	...	1	101	583
Italy	45	796	...	...	...	...	...	...	...	1,852	2,693
Austria-Hungary...	...	304	...	434	...	783	...	18	1,395	340	3,275
United States	1,627	267	225	965	647	9,647	4,865	83	223	276	18,825
Canada	...	...	45	...	...	43	...	...	...	...	88
Total, £	3,257	13,033	2,402	25,084	4,188	38,693	5,713	2,218	8,465	27,593	130,646

Additional imports: Spain, carbons, £25; New South Wales, electrical machinery, £7.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	1,825	278	...	2,821	...	3,550	...	181	932	6,004	...

TOTAL EXPORTS: £302,849. TOTAL RE-EXPORTS: £15,591. TOTAL IMPORTS: £130,678.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

CATALOGUES AGAIN.

By "QUID NUNC."

It will probably be admitted, when one considers the different forms of catalogues, price lists, &c., that the filing of these really seems a vexed question. For instance, there are the firms who advertise their goods by sending out a handsome bound book, large enough in some instances to take up two or three inches of space; others send out as many as three smaller volumes; again, we have the single sheet, sent out at intervals, and the large beautifully illustrated stiff cardboard advertisement for hanging on the wall; then there is the large illustrated sheet, presumably for pasting on the wall; we next have the loose-leaf-holder arrangement, in order that further sheets issued may be inserted therein, and the very small pamphlet suitable for the waistcoat pocket. Unless this variety is separated into some order or other, the result must necessarily be chaotic.

Whilst the writer does not claim perfection for the system now advocated, he may state that the method has worked admirably and without hitch for a number of years past, and it further has this advantage: only the latest books and lists are kept; unless this is done, the accumulation of old and out-of-date matter will grow to an alarming extent, necessitating a periodical overhaul, which in an engineering department means rather a large order.

The first factor to be considered is an efficient system of indexing; without doubt the card index claims many advantages over the ordinary alphabetical book index, and as the advantages are so well known, it is not necessary to describe them.

The following is a suggested ruling of the cards:—"A" for indexing under name of firm; "B" for cross-indexing under name of article.

A.

Name.....

Address .....

Telegraphic Address.....

Description of article.	Catalogue No.	Location.

B.

Description of article.	Catalogue No.	Location.

The next step to consider is the arrangement, and the following method is suggested:—All catalogues in book form should be numbered, and placed in numerical order on shelves separate from the other classes of catalogues. Leaflets, pamphlets, &c., should be numbered and filed in cases; where a sheet is too large, it should be neatly folded. The cases should be numbered and placed in numerical order on their particular set of shelves. Suitable cases can be obtained 15 in. × 10 in. × 3 in. deep, with a spring clip to hold the papers in position, at a very reasonable price. All lists of the large cardboard type should be numbered and placed in order on another shelf; very little space will be required for these, as they are not very numerous.

For indexing, a small gummed disk should be affixed to the back of the books and numbered; the card written up, with the number given to the book, the location, and other particulars regarding name, specialities, &c., and the card placed in alphabetical order in the tray. With regard to books, no cross-indexing is necessary, as the specialities of the firms issuing these books are generally well known, and to endeavour to cross-index every article described would entail too much unnecessary labour; moreover, the books contain, as a rule, a very complete index of their contents.

Single sheets, pamphlets, &c., should be numbered; a small gummed disk affixed to the top of the sheet, or on the top of the cover of the pamphlet, is suitable for this purpose, and the sheets or pamphlets should be placed in the case in numerical order, after the index card has been written up. The number in each case should start from 1; the number and location on the index card will be described thus: "Catalogue No. 1; Location, Case 2," or as required; the disk on the catalogue will be marked likewise "No. 1 C2," so that when taken out of a case for reference, it can always be returned to its proper case and placed in numerical order. Cross-indexing should be used in the case of single sheets and pamphlets by aid of the cards already described. It is not necessary to write up a fresh card for every article, as a card can be used for the same class of article until full, and a new card can then be inserted behind it.

It is advisable not to fill the cases to anything like their full limit, as leaflets and pamphlets may arrive from a firm whose name has already been indexed, describing other articles. The number in this case should be given thus:—Say the number of the first sheet received is 20, the next sheet received from the same firm should be numbered 20·1, the next 20·2 and so on, and entered up on the card index accordingly; thus all sheets, &c., belonging to any particular firm are kept together.

Before filing, reference should be made to the index, and if a catalogue has already been received from the same firm describing the same speciality, the new catalogue should be given the same number, the old catalogue taken out and destroyed and the new one put in its place. No further indexing is required, as the name of the firm and particulars are already in the index, and by this method only the latest lists are retained.

EVAPORATIVE CONDENSERS.

By E. KILBURN SCOTT.

The efficiency of a surface condenser over other types is well known, and also the effectiveness of a cooling tower for saving condensing water. But the possibility of combining these two in an evaporative condenser is not so well recognised.

At the Southend electricity works such an evaporative condenser, made by Messrs. Ledward & Beckett, is in use, and it has been such a great success that some data respecting it may be of interest. Although Southend is a seaside resort, the sea, when the tide is out, is over a mile from the power station, and it is therefore impossible to use sea water for condensing purposes. Town's water has to be used, and as it is 1s. 6d. a gallon, the engineer, Mr. Birkett, recognised the importance of economising it if possible.

The apparatus which has been installed is capable of dealing with 60,000 lb. of steam per hour, and it takes the place of two separate sets of cooling towers and surface condensers.

With the new arrangement, a better vacuum can be obtained, ranging from 27 to 25 in., according to load, with only a quarter of the water when running on load. Also no water at all is used during the daytime, when on light loads, because the pipes give up their heat to the surrounding atmosphere. The evaporative condenser consists of 2,160 cast-iron corrugated tubes, laid horizontally, and built up into sets something like economiser tubes. Under the pipes there is a large brick tank filled with water, from which two motor-driven circulating pumps raise the water to distributing perforated pipes on the top of the condenser. The lift is only 14 ft., whereas with the old cooling towers it was nearly 30 ft.

The steam from the engines enters the cast-iron tubes at the top, and as it is condensed it is tapped off at intervals from the pipes below. The pipes are therefore freed from water directly it is condensed, as in the Contraflo type condenser. This hot water goes straight to the boilers through a rotary "wet" pump, and so a great deal of heat is saved, and the water has no chance to become aerated.

The Southend plant has two three-throw motor-driven Edwards air pumps, either of which is capable of dealing with the whole of the steam, except at periods of heaviest load. These air pumps remove the vapour and air, as well as the water of condensation, from the last three tubes in each coil. The water is delivered into the hot well, and from there it is fed into the boilers by feed pumps.

One of the old plants, which dealt with only half the load, required 75 B.H.P. in power, whereas the new plant, dealing with the full load, absorbs only 22 B.H.P. During the daytime the light load only requires 9 B.H.P., this being the power of the air pump. As soon as the plant was put to work it saved 80 per cent. of the water used in the station.

A similar, but smaller, plant to the one at Southend has recently been started at Bridlington. The borough engineer, Mr. A. J. Beckett, called for a guarantee of coal saving, and Messrs. Ledward & Beckett, with the Southend and other data to go upon, were able to guarantee 25 per cent. The tests carried out last month showed 26·7 per cent. saving, with the barometer at only 29·1 inches.

The above appears to indicate a way in which many of the smaller municipal plants might turn an annual loss into a profit, for although the first cost of the evaporative condenser is more than that of the old arrangement of a separate condenser and cooling tower, it is only a small percentage on the total outlay on the station.

A 150-TON ELECTRIC TITAN CRANE.

Within recent years a type of heavy electric wharf crane, known as the hammer-head or cantilever titan crane, has been designed and constructed to meet the demands of marine engineers and shipbuilders, and several large cranes of this pattern have been erected in this country and abroad. These cranes are of two distinct types of construction; the early type, favoured in Germany, consists of a horizontal jib, carrying the travelling jenny, and secured to a vertical shaft passing through a tower to the wharf level, where the slewing gear is fixed. At the top of the tower, which extends nearly to the underside of the jib, horizontal rollers are placed to permit of easy rotation of the internal shaft and jib. The duty of the tower is simply to resist the horizontal force of the wind, and to maintain the internal mast or shaft in a vertical position. In the titan type, or British design, the horizontal jib is placed upon a ring of live rollers resting upon the top of the tower, which supports the whole of the live and dead loads in addition to resisting the overturning force of the wind. The British designs are simply rim-bearing swing bridges on tall towers. The principal advantage of the titan type is more substantial construction; the deflections are about one-third those of the hammer-head type, and the amplitude of vibrations about one-sixth. The steadiness in lowering is a great advantage in dealing with heavy loads, and allows them to be placed more rapidly in their correct position.

An electric titan crane of 150 tons capacity has just been completed for the North-Eastern Marine Engineering Co. at their Wallsend Yard, by Sir William Arrol & Co., of Glasgow. It consists of a tower 125 ft. in height and 40 ft. square at the base, and carrying a ring of live rollers on top, upon which a horizontal jib, having a total length of 245 ft., is supported. The long arm of the jib has a total radius of 150 ft. The jib is fitted with slewing gear to revolve it in either direction, and has racking gear and separate lifting motions for the main and auxiliary hooks.

The speeds of the various motions are as follows:—

Main lift	150 tons...	...	at	5 ft. per minute
„	100 „ ...	...	at	7½ „ „
Auxiliary lift	30 „ ...	...	at	12 „ „
„ „	7½ „ ...	...	at	50 „ „
Racking	150 „ ...	...	at	40 „ „
„	30 „ ...	...	at	100 „ „
Slewing	150 „ ...	...	1 rev. in	10 minutes
„	30 „ ...	...	1 „	5 „

The total height of lift provided for is 173 ft., viz., 143 ft. above and 30 ft. below quay level. The height from quay to rail level is 156 ft. The racking and lifting machinery is placed in a steel-plated house at the tail-end of the jib, and assists in counterbalancing the crane. The slewing gear is placed in a steel-plated house over the circular rack at the back end. The operator's cabin of steel plating containing the controllers and resistances is placed on the right-hand girder of the jib, and is provided with projecting windows, so that a clear view is obtained of the load at all times. It is connected to the machinery house by speaking tubes, and by telephone to the ground.

The foundations of the crane are formed of four steel cylinders founded upon hard boulder clay at depths of 73 ft. for the two front cylinders, and 58 ft. for the two back cylinders, subsequently filled with concrete.

The tower is constructed of four legs of open angle section, forming a square 40 ft. at the base, tapering to 35 ft. at the top, braced together by three bays of horizontal and diagonal bracing of braced box section. The centre pivot pin, 14 ft. long × 18 in. diameter, passes through the cross girders of the tower at their intersection and through a box girder secured to the jib main girders and the drum girder. It provides a centre of rotation for the jib and prevents its displacement. To provide for emergency loading and a construction of a substantial and durable character, the centre pin, with the girders carrying it, is designed to resist a vertical or horizontal force of 100 tons, although, by the construction of the crane, no tension will be on the pin under any ordinary conditions of the loaded or unloaded jib, as the centre of gravity does not approach at any time nearer the centre of the roller path than about 3 ft. The centre pin and the castings which revolve round it are bushed with hard gun-metal. The collector rings are fixed above the head of the centre pin, and the electrical cables are brought up through a 5-in. hole bored through the centre of it.

The mean diameter of the roller path is 35 ft. The upper and lower tracks are of cast-steel, 2½ in. in thickness, and their rolling surfaces are machined to form conical surfaces with a common vertex at the centre. There are 75 rollers of solid forged steel, 14 in. mean diameter, 14 in. in length and spaced about 16½ in. centres. The circular slewing rack is 5½ in. pitch, and is bolted to palms cast on the lower roller path. The upper roller path is carried by a drum girder, 35 ft. diameter, 24 in. deep, and 24 in. wide. It is of sufficient strength and stiffness to distribute the maximum pressure from the full load being lifted over 19 rollers.

A pair of open lattice girders, 14 ft. apart, and braced together, was adopted for the jib, which is 26 ft. over the tower; ballast tanks are placed under the machinery house at the tail end and contain 65 tons of counterweight. Four lines of bridge rails are provided, one over each web of the box girders, and are riveted to the top flanges.

All the motions are actuated by Westinghouse motors, and for convenience these have been made of the same size throughout, being all of 50 B.H.P., running at about 380 R.P.M., and worked on direct current of 480-500 volts.

Two of the motors actuate the main hoisting gear, and these are arranged to run in series or parallel, giving a further range of speed, besides that supplied by the change of gearing. The main lifting barrel is 10 ft. in diameter; it is spirally grooved, and takes the whole of the rope in one lap. It is driven by a very fine steel spur-wheel, keyed directly on to the barrel, and the teeth of this wheel are specially formed, to give great strength at the root.

The main hoisting rope is 5 in. in circumference, and the load is lifted on 12 parts, two parts being led direct from the barrel; this gives a six-fall purchase in the ropes.

On the main hoist there are magnetic brakes controlled by solenoids, and mechanical releases for emergency use are fitted.

In addition, there are rheostatic braking points in the controllers, but a notable point as regards the arrangement for lowering is the adoption of "Matthew's" hydraulic brakes, which give an extraordinarily delicate control of lowering. The hydraulic brakes consist essentially of a pair of water cylinders, containing pistons; these pistons are driven from cranks at right angles, actuated by the main gear when lowering. The cylinders are provided with a by-pass, with a specially designed valve, allowing the water to pass from back to front of the pistons as required for lowering at any desired speed. The heat generated in the hydraulic cylinders is carried away by water-jackets to circulating tanks.

The connection of the water-cylinders to the gearing is such that the pistons are not actuated when lifting, and therefore do not cause a drag on the lifting motors. The effect of the arrangement is that lowering can be performed with absolute smoothness; this, combined with the extreme rigidity of the steel structure, keeps the pulsation of the load within extraordinarily small limits, a point that will be appreciated by all those who have attempted to accurately place loads in position when being lowered from elastic cranes with a great pulsating deflection.

The auxiliary hoisting gear is worked by one 50-H.P. motor, and, as mentioned above, is fitted with two speeds, and this also has magnetic, mechanical and rheostatic brakes.

The racking motion is worked by a separate motor, actuating a barrel on which coils off and on the 3-in. circumference rope, which propels the jenny.

The gearing is mostly of cast-steel, the first reductions being in oil baths.

The travelling jenny runs on 12 double-flanged cast-steel wheels, rolling on two rails on each cantilever. Compensating pulleys are placed at the end of the jib, to ensure equal stresses on the ropes. The load is lifted by a heavy forged hook, attached to the snatch-block, through the medium of a ball bearing.

The driver's cabin is very completely fitted up, with switchboard, ammeter and voltmeter, no-voltage releases and the usual fuses, and there is also in the cabin an indicator, to show the radius at which the jenny is working. This indicator has a glass front, behind which lamps are placed; the lights appear and disappear in succession as the jenny moves down the jib. The cabin also contains the working gear for the brakes, and for actuating the hydraulic valves of the hydraulic brakes.

The slewing gear is actuated by a 50-H.P. motor of the same type as the others; this drives the main slewing pinion, through the medium of a set of gear wheels, which are self-contained on a massive bracket, fitted to the upper slewing ring. A powerful solenoid brake is fitted to the slewing gear. Releasing gear is fitted to the brake, so that the crane may come round to the wind when not in use.

A new feature in this crane is the adoption in the machinery house of a complete electric traveller, a trap door being so arranged in the floor of the house, that a 2½-ton load can be lifted right up from the ground to the machinery house. This is a great convenience for changing armatures or dismantling for repairs or cleaning.

The crane was erected by means of a 15-ton steam crane placed on top of a travelling timber stage, which was about 100 ft. in height. In its first position the crane erected the whole of the tower, live ring and portion of the jib over the tower, and it was gradually moved towards the tail end to erect the remainder of the jib and machinery. While the tail end was being erected the long arm was built from a 3-ton hand crane, which was pushed forward as the erection proceeded and the crane kept in balance.

The tests of the crane were successfully completed on July 2nd, when it was put through all its evolutions with a test load of 187 tons, 25 per cent. over the maximum working load. The maximum deflection was 7 $\frac{7}{16}$ in. under the 187 tons load and 6$\frac{1}{2}$ in. under 150 tons. The amplitude of the vibrations was observed during the tests, and did not exceed $\frac{1}{16}$ in. under the 150 tons load.

We are indebted to Mr. Adam Hunter, M.Inst.C.E., chief engineer to Sir W. Arrol & Co., for the above particulars.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

The single-phase system on the suburban railway between Blankenese and Ohlsdorf has answered so well in conjunction with an expansion in the traffic, that the State Railway authorities have ordered a further batch of 25 motor coaches. It is said that the favourable experience gained with this line will probably contribute towards the speedy introduction of electric traction on the Berlin City Railway. A similar prediction has been made on former occasions, but now, as then, the State Railways make haste slowly.

The close connection which was financially established between the A.E.G. and the Swiss firm of Brown, Boveri & Co. in 1904 has now been dissolved, and the directors in the one company have retired from the board of the other, and *vice versa*.

The Wolfram Lampen Gesellschaft, of Augsburg, reporting on the year 1908-9, which was the first year since the taking over of the Bavarian incandescent filament factory, states that the manufacture of the Just metallic-filament lamp experienced a further satisfactory development. The continued trials in the direction of the improvement of the tungsten lamp for working on a large scale had, however, resulted in a complete transformation of several departments, and this was the principal cause of the unfavourable trading for the year, although the advantages of the alterations would be observable in future years. The demand had become brisker, and sales were further increased notwithstanding the advent of severe competition. It had recently been possible in a short time to place on the market 16-c.p. tungsten lamps, as well as lamps of 600 and 1,000 c.p. The constant increase in the scope for the productions was, however, being accomplished with constant concessions in prices. It was proposed to extend the Lechhausen factory, and the work would be commenced in this year. An agreement had been entered into with the International Wolfram Lamp Co., of Buda-Pesth, and the United Glow Lamp and Electricity Co., of Ujpest, whereby the market for the company had been substantially enlarged. The accounts show a loss of £10,100 for 1908-9, which is to be covered out of the reserve fund, on a share capital of £150,000. The directors add that the effects of the new lamp tax could not be foreseen, and that the financial consequences of it would probably have to be borne by consumers.

The directors of the Swiss firm of Brown, Boveri & Co., of Baden, state in their report for 1908 9 that the whole of the year stood under the influence of the general crisis in trade, and the reason the company was able to propose the same rate of dividend was principally to be found in the circumstance that many old orders were completed in the 12 months. Moreover, the works were fully employed without interruption, owing to the numerous special branches worked up by the company. The sale prices were further depressed, and the general expenses increased annually, and, notwithstanding improvements in manufacture, a diminution of the financial results could scarcely be avoided unless prices became firmer by a general revival in trade. The financial results for the past two years are as follows:—

	1908-9.	1907-8.
Share capital	£800,000	£800,000
Bond capital	400,000	400,000
Gross profits	275,000	262,000
Depreciation provision ...	22,100	36,600
Net profits	110,000	94,000
Dividend	88,000	74,800
Per cent.	11	11

The report proceeds to state that the company is very actively employed principally on the construction of generators and transformers of very high output, and the single-phase commutator motors have become a bulk article of manufacture. These motors have also been developed to great perfection for railway working, and the company is in course of building locomotives on this system for large powers. The work of converting the Swiss Seethal Railway to electric traction on the single-phase method is proceeding, and is to be completed in the next few months. The invoice value of the steam turbines has declined partly in consequence of lower prices, and partly because of the circumstance that a standstill has been reached in the erection of large central stations. As to the electric lighting of trains, 2,000 coaches have been equipped, mainly on the Swiss Federal Railways, and a further 1,000 coaches are in prospect. It is added that the works are fully employed, and that the orders on hand on April 1st were only inconsiderably less than those at the corresponding period in 1908.

The Compagnie Internationale d'Électricité, of Liége, which has a share capital of £251,000, and a bond issue of £83,000, realised gross profits of £36,400 in 1908-9 and net profits of £17,570, the latter of which has been devoted to the purpose of depreciation in order to consolidate the financial position. If the results are less than in the preceding year, the directors state in their report that the circumstance was notably due to the fact that during the final months the workshops were not fully employed owing to the crisis in trade in general, and because the extraordinary profits were less considerable. It was also necessary to take into account that profits resulting from the construction and working of the Liége central station for the city had not been included in the balance-sheet, although the works were nearly completed on April 30th. The station was now in operation and the current year would benefit from the operation of the undertaking. The order book was at present well filled, and the amount was higher than at the same date a year ago. The economical organisation of working in the shops had made fresh progress, and the company had started the manufacture of standard series of dynamos and motors, the increasing demand for which had stimulated the construction of new and very economical types. The branch at Paris continued to yield satisfactory results, but as the English market had not improved, the company had closed the London office and would endeavour to dispose of its manufactures direct.

The report for 1908 of the Austrian Siemens-Schuckert Works Co., of Vienna, states that the number of consumers again experienced a considerable increase; the turnover was materially greater, and all departments, including the newly associated cable factory, were fully employed. Among the orders received during the year are mentioned those for 11 central stations and four tramways, and extensions for 49 stations and six tramways, together with power transmission and lighting plants, &c. The output of the machines delivered was 170,000 kw., or 60,000 kw. in excess of 1907, and the number of workmen employed at the end of 1908 was 4,000, as against 3,700 at the close of the preceding year. The accounts show net profits of £45,000, as compared with £34,200 in 1907, and a dividend at the rate of 5 per cent. has been declared, this contrasting with 4 per cent. in the previous year.

THE AUDIT OF THE ACCOUNTS OF TRAMWAY UNDERTAKINGS AND TRAMWAY FINANCE COMPANIES.

By "ACCOUNTANT."

The construction of tramways is governed by the Tramway Act of 1870. Discussion of that Act, or of the procedure by municipal authorities and companies incidental to the promotion of a tramway order not being germane to our subject, we may conveniently eliminate it from our introductory observations.

It is proposed to present as briefly as possible an outline of some of the more important matters which come within the purview of the auditor in relation of his duty towards the accounts of tramway undertakings, and to notice some of the principal points that appear in tramway finance. The subject possesses features probably more instructive than interesting.

The usual practice is for a copy of the balance-sheet and profit and loss account, with convenient schedules, to be submitted to the board, discussed, and the approval of the directors minuted in the ordinary way, copies of these documents, as approved by the directorate, being supplied to the auditor when he subsequently commences his audit.

It is assumed that the auditor is familiar with the Memorandum and Articles of Association, so that he may ascertain whether the nature of any of the transactions which have transpired, or which have been entered into, have been or are within the powers of the board or the company, and that the Articles of Association have not been disregarded or transgressed in the carrying out of such transactions, and in the general administration of the affairs of the undertaking.

It is a common assertion that accountancy attains the apex of interestedness only on occasions of stress of necessary funds, which is frequently true in practice.

Two of the preliminary duties are (1) to check the commencing balances, and (2) to read carefully the minutes, noting anything which may be important or unusual, and the effect, if any, in some instances which has been given to the resolutions of the board in matters of account.

The manner in which some descriptions of assets and capital expenditure are assembled and presented in groups in balance-

sheets leaves much to be desired. The inference is obvious, and the practice, needless to state, does not contribute to that reasonable fulness and lucidity of balance-sheets which is so essential, but which is so generally neglected.

Treating, first, of the accounts of tramway companies proper, we may proceed to sketch some of the principal features of the auditorial work. Incidentally, it may be observed that the books in use at the chief office are of the usual design and variety, and generally embrace ledgers (personal and impersonal), cash books and journal.

In some undertakings the accounts are recorded in separate ledgers, viz.:—

Real accounts ...	1. Accounts of debtors and creditors.	Personal ledger.
	2. Accounts of stock, construction, investments.	Real accounts ledger.
Nominal accounts	Accounts constituting the revenue or profit and loss account.	Nominal accounts or revenue ledger.

Personal accounts, where the accounts are regularly paid, may be avoided to a certain extent by merely dissecting the invoices in a purchase book with dissecting columns, and posting the total of each dissection to the debit of the impersonal account concerned, each invoice after payment being pasted in a guard book and numbered and indexed, a corresponding reference being indicated opposite each entry in the purchase book of the number and folio of the invoice in the guard book.

There is not anything unusual in the form of the general cash book. The tramway business being essentially one of cash, the entries on the debit side of the book consist, with few exceptions, almost entirely of traffic receipts, returns of which are sent daily by the traffic manager's department to the head office, and which are posted in monthly total to the credit of a traffic receipts account in the impersonal ledger, the postings being checked in the ordinary way.

As part of a proper system of internal check, these returns should be compared from time to time with the traffic book and way bills. The receipts, which are paid into the bank daily, should be checked with the daily advices and pass books. To vouch them to their foundation, it would be necessary to check the daily advices with the daily traffic book, that book with the conductors' way bills, and the way bills with the ticket issue book, as regards the issue of tickets.

There are, of course, from time to time, sundry receipts arising, *inter alia*, from the sale of materials and old and superseded plant, which may be compared with the pass book and the documentary proof of sale.

It is essential that the allocation, as between capital and revenue of these sales, should be carefully scrutinised and questioned if the documents are explanatorily deficient. Generally, it will be found that there are proper advices from the traffic and engineering departments, and that the debit notes have been impressed in an invoice copying book.

The payments arise in respect of purchases of stores and materials, plant, directors' fees, wages, salaries, and so forth, and the usual receipts will be available, whilst the postings will be checked as usual. These receipts should be kept quite distinct from the accounts and numbered with the corresponding numbers of the entries in the cash book.

According to the magnitude of the undertaking and the routine adopted, it is not unusual to find several accounts opened for the record of petty expenditure, such as head office, traffic department, and engineering department. There will be formal receipts by the persons to whom the cash is given, and by whom it is accountable, as well as the production of the usual vouchers for the payments. In that event there are generally separate books for each department in which the expenditure is recorded and allocated, the books being sent to the head office with the vouchers monthly where they are checked, the necessary entries made, and a copy of the allocations made for the use of the auditor and the office somewhat in the following form, viz.:—

Month.	Cash in hand.	Cash received during the month.	Total.	Allocations.			Total.	Balance.
				Stock.	G. E.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.

The auditor is dependent, of course, upon the allocations as between capital and revenue of those responsible for each department.

It is usual to indicate in the cash book at the end of each month a reconciliation statement agreeing the cash book balance with that of the bank pass book.

Bank certificates will be available for the balance of the current account, any deposit or deposits accounts, and any balances of dividend or debenture interest accounts, whilst the existing balance of the petty cash book will be checked backwards and agreed with the balance as at the date of the accounts.

Current and deposit accounts should be shown separately in the balance-sheet, and distinct prominence should not be denied to the cash held by the bank in special accounts for the satisfaction of unclaimed liabilities on dividend and debenture interest accounts.

It may be observed that the total amount of cash taken on account of traffic receipts on the last day of the financial year will not, of course, be on that day. The difference will be checked with the daily advice of traffic receipts, and included in the reconciliation statement as cash received but not paid into the bank.

The cash discounts received by the company are either included as a credit in the schedule of details of the general administration expenses, or are exhibited separately as a credit in the profit and loss account.

Care should be taken to see vouchers and allocations for items posted direct from the cash book to impersonal accounts.

It is customary for all purchase and other accounts, after being certified by the responsible persons concerned as to condition, weight or quality, and also after having been dealt with by them in their books, to be handed to the head office, where they are checked with the orders issued for prices, discounts, additions and extensions, when they are entered in a purchase day-book with columns for the allocations and consequently for the impersonal accounts, each entry being posted to a personal account, and the total of each allocation to an impersonal account in the ledger. All the work just indicated finds indication on each invoice before it is submitted for payment. The postings from the purchase day-book are carefully checked, and the entries therein vouched, each invoice or complete or incomplete documentary evidence being carefully scrutinised. Special attention is devoted to the allocations.

Inquiry should be directed as to the existence of any unpaid accounts, which may not appear in the books, whether all invoices and accounts have been received and recorded in the books of account in respect of goods delivered or other consideration received during the period of the accounts under audit.

It is a usual custom for returns to be made to the head office monthly of stores received and of allocated issues from stores, as well as of wages and salaries and their allocation, the returns being certified by the persons responsible therefor. Of the utmost importance are the appropriations to capital and revenue, which are generally accepted by the auditor unquestioned, as it would be futile in most cases for him to go behind the certified allocations of the departmental heads, though it has occurred that expenditure, which was obviously of a revenue nature, has been allocated deliberately to capital in the course of a strenuous and successful exertion to pay an ordinary dividend. The allocations are journalised and posted to accounts in the impersonal ledger, with convenient titles for their reception. Salaries and wages are similarly treated. Full details of all appropriations to capital, whether from stores, wages, salaries or petty cash, should be available.

In the ordinary course there are few debtors. Such as do arise are due mainly to sundry sales of materials and miscellaneous forms of indebtedness which it is unnecessary to particularise. Incorporated therewith are "and debit balances," sometimes known as payments in advance as, for example, proportions of insurance premiums inapplicable to the period represented by the accounts. A schedule should be in evidence showing the name and amount of each debtor, and the details of the debit balances mentioned.

Sundry creditors, with which is commonly incorporated "and credit balances," such as rent accrued at the date of the accounts, comprise mainly invoices for goods supplied during the concluding part of the financial year.

Cash creditors should be indicated separately. As in the case of sundry debtors and debit balances, a schedule should be available of the sundry creditors and credit balances. There is generally a record in book form of standing charges, such as rents, rates, different descriptions of insurances, wayleaves, directors' fees, office salaries, and other similar charges which may be consulted by the auditor for the purpose of satisfying himself that all permanent and accruing charges have been accounted for in the accounts under review. Inquiry should be made as to any claims for which the company may be not wholly protected by insurance in respect of accidents pending or outstanding at the end of the financial year, and if so, whether it is desirable to make provision therefor in the accounts, if none has been made already.

Should there happen to be a public issue of unissued shares or of debentures, there will be recorded as authority the necessary resolutions of the board. The subject of reserve capital does not arise in practice in tramway undertakings. The usual routine followed is to check the applications with the allotment lists which are initialled by the chairman of the meetings at which the allotments were made, the total cash received with the pass books, and with the entries on the debit side of the cash book of the transfers from application, allotment and the different call accounts to current accounts, and any entries on the credit side of the cash book of tranafers to deposit account.

It is the practice in some instances for the transfers to be checked periodically by the auditors. This, however, may be a matter for inclusion in the system of internal check.

Share warrants to bearer do not obtain except in foreign enterprises. The warrants are sent to the bank of the local office by the company's bankers, the charges being insurance (for face value), postage and commission, instructions being given to the bank to deliver the warrants in exchange only for payment of the nominal sum indicated upon them, or other sum if issued at a premium.

It is desirable to ascertain the number and value of any share warrants unissued and on hand.

With regard to any item of forfeited shares the auditor will, of course, consult the articles of association and the minutes.

The subject of exchange plays an important part in the administration of tramway concessions abroad in regard to finance and home remittances. For instance, the Portuguese Exchange will sometimes rise or fall very rapidly. Just lately the exchange at Lisbon was $42\frac{3}{8}$, which means about 5$600 per £. An hour or two later the cheque rate was $47\frac{1}{4}$, which is equivalent

to about 58050 per £. The subject is adequately treated in "Johnson's Foreign Exchanges in Accounts," which is applicable to the accounts of foreign tramway concessions.

Where a company has been operating for some years it is not unreasonable to apprehend that the trading has yielded an accumulated and undivided surplus in the shape of a reserve fund. Reserve funds in tramways are unfortunately somewhat remote. So-called reserve funds, however, in tramway undertakings are with rare exceptions technically not entitled to claim the distinction of reserve funds, and in some instances they have been accumulated mainly out of capital profits as distinguished from profits on revenue account.

There are, of course, in vogue working and pooling arrangements with municipal authorities, which are of a varied character. The company may in some cases pay the sinking fund and interest, or participate in a share of the profits. Then there may be running powers. With all of these matters the auditor should make himself familiar when checking the sums due from one party to the other, and scrutinising the periodical settlements.

Generally, provision for obsolescence *per se* has been and is a negligible quantity, though its importance is none the less recognised; but the necessary prior demands upon an insufficient revenue, seem in many cases to discourage the attainment of a reasonable credit balance for the object indicated. The sums periodically devoted to depreciation and renewal are generally extremely inadequate, and are dependent as a rule upon the amount available for ordinary distribution. Though there is no general rule, on the basis of generalisation, 1d. per car-mile is usually recognised as a fair rate of estimate for depreciation.

In some auditors' certificates, where no provision has been made for depreciation, it is stated that the question as to what provision is required to meet depreciation is left to the directors and shareholders to determine. Such a statement is of no value, and is hardly within the province of the auditor. He should merely state whether depreciation has been provided for or not, and that he does not express any opinion as to its sufficiency, or otherwise.

In the promotion and construction days, legal charges and their allocation require more than ordinary attention.

Expenditure upon unsuccessful promotions and abandoned bills should, of course, find its last rest in the profit and loss account.

The stock of a tramway undertaking consists of consumable stores and materials and working tools and plant, for which there may be distinct accounts in the books, and for which there will be produced the usual certified inventories. Any unuseable stores or materials in stock should be sold, and if unsaleable, written off. Similarly with working tools and plant worn out or lost, the remainder being subject to a substantial deduction for depreciation. In balance-sheets such accounts are amalgamated and exhibited as a single item.

In the traffic manager's office there is kept a record of tickets received from the ticket printer, and particulars of those issued to the conductors, of which a monthly return is made to the head office, showing the balance of each description of ticket in hand at the end of the month. The balance at the end of the year should be checked with the actual stock, and forms part generally of the internal system of check and control. In those cases where horse or any other system of traction has been converted into that of electric, the converted asset, less what has been realised in respect of the sale of old materials therefrom, is not written off against revenue, though it is non-existent, but is allowed to remain in the capital expenditure until the doom of the undertaking. Needless to say, such remaining expenditure is in some cases of huge proportion, and is seldom exhibited in open relief in balance-sheets. In this connection it may be not an inappropriate comment that all such expenditure is written off by municipal authorities, though the length of time involved in the process is as the tenure of the oans affected. The whole of the sinking fund is an appropriation of revenue, which obviously means a deduction from the capital expenditure concerned.

(*To be concluded.*)

PROCEEDINGS OF INSTITUTIONS.

Institution of Mining Engineers.

THE twentieth annual general meeting of this Institution was held at Newcastle-on-Tyne on the 15th, 16th and 17th inst., there being a considerable gathering of members from all parts of the country. The proceedings were opened on the 15th inst., in the Wood Memorial Hall, Newcastle-on-Tyne, with a civic reception by the Lord Mayor and representatives of the municipality, who gave the members a hearty welcome to the "Canny Toon." The annual meeting was then opened by Dr. R. T. Moore, the retiring President, who introduced Mr. J. B. Simpson, the President for the ensuing year. The remainder of the day was given up to the reading of the annual report, and a number of papers. Several other papers were down for discussion, but these were not reached by the time when it was necessary to terminate the day's proceedings. The annual dinner was held at the Armstrong College, in the "King's Hall," in the evening, under the presidency of Mr. J. B. Simpson, who was supported by Sir Henry Cunynghame, Mr. T. E. Forster, President of the North of England Institute of Mining and Mechanical Engineers, the Deputy Lord Mayor, and others. Sir Henry Cunynghame, in proposing "the Institution of Mining Engineers," said, in speaking of the papers read during the meeting, that he was more than pleased when one member said "there was no need to call in foreign engineers to show us how to overcome difficulties in mining." He (Sir Henry) had been in Germany and other countries on behalf of the Home Office, in the company of eminent English mining engineers, and in all cases they found that the mines abroad were far behind those of our own country, from a mining engineering point of view. They had far too much on the surface and too little below ground, and he hoped that the mining engineers of this country who were prone to applaud and adopt German plant would see what our own country could produce before rushing abroad. If they gave British manufacturers a fair chance, he had no reason to think that they would have any difficulty in producing exactly what they wanted, and a very great deal better than they could obtain elsewhere. We sincerely hope these words of Sir Henry will receive the attention they richly deserve, and that our British mining engineers will remove their objections to "British manufactures." It is absurd to say that there are no electrical engineering firms in this country able to deal with large main winding engines, such as that seen at Harton Colliery on the following day, as we very much question whether they ever had an opportunity of quoting. We were glad to notice that the mechanical portion of the above-named winder was by a British firm, but one had not to look far to see that the remainder was German. The British mining engineer is the best in the world; but he would appear to be fast losing his patriotism, so far as the application of electricity is concerned. We hope, therefore, that the words of Sir Henry Cunynghame will be as "seed fallen upon good ground." On Thursday, the 16th, the members visited the Carville power station of the Newcastle-upon-Tyne Supply Co. and Harton Colliery, belonging to the Harton Coal Co., Ltd., who are gradually replacing their steam-driven plant with electric, the current being taken from the above-named supply company. The following description of both the power station and the colliery will, no doubt, be of interest.

Carville Power Station.

This station, which has a total capacity of 56,000 H.P. in plant installed, consists of the engine house and three boiler houses placed at right angles thereto. Each boiler house is complete in itself, with coal bunkers, boilers, mechanical stokers, economisers, induced draught fans, feed pumps, ash conveyors, &c. Coal is brought in by overhead sidings, and water for condensing is pumped to the station from a pump house at the river side. With the exception of the feed pumps, all the auxiliary machinery is electrically driven.

No. 1 boiler house contains 10 Babcock & Wilcox marine type water-tube boilers, each capable of evaporating 20,000 lb. of water per hour at a pressure of 200 lb. per sq. in., superheated 150° F. Two economisers of 480 pipes each are placed in the main flues to the chimney.

Nos. 2 and 3 boiler houses each contain eight Stirling water-tube boilers, each capable of evaporating 33,000 lb. of water per hour. In these boiler houses each boiler is fitted with its own economiser of 120 pipes.

All the boilers are fitted with chain-grate stokers, which are fed with coal direct from overhead bunkers. The coal bunkers of each boiler house will contain about 800 tons.

The induced draught is maintained by means of Sirocco fans driven by electric motors. The chimneys are 14 ft. in diameter and 120 ft. high.

The engine house contains eight Parsons turbo-alternators of 7,000 H.P. each. The condensers and air-pumps are situated below each machine. The alternators run at 1,200 R.P.M., and generate three-phase current at 6,000 volts and 40 cycles per second. Each alternator supplies current at a reduced voltage (by means of a transformer) to its own auxiliaries, which include air-pump, circulating pump, ventilating fan, and exhaust-valve motor, and also to the corresponding auxiliaries for the boilers supplying the steam.

The main switches, which are each in a concrete cell, are of the remote-control type, operated by electric motors. The switches are each capable of controlling circuits normally carrying 10,000 H.P., and there are, in all, 47 switches. There is also an auxiliary board of the ironclad type, which contains eight switches, each capable of controlling circuits of 3,000 H.P.

The whole system is operated and controlled from the control-room by the "system engineer," who is in direct telephonic communication with each sub-station in the area, which now covers some 700 square miles. The control-room contains a large diagram

of the whole system, and upon it a record is kept of the positions of all switches.

Adjacent to the control-room are the operation offices and telephone exchange, from which the large private telephone system of the company is operated.

In the sub-station near the control-room are installed two large step-up transformers for raising the pressure from 6,000 to 20,000 volts for transmission to the extreme north and south of the area. The transformers are of the oil-immersed air-cooled type, each of 3,300 B.H.P. There are in all eight transformers of this size on the system.

At the northern end of the power station there is a step-down sub-station of 4,000 H.P. capacity, which supplies current to adjacent works.

The bottom of the pump house is below the level of the lowest tide, to enable the pumps to be drowned at all states of the tide. The pumps, seven in number, are of the centrifugal type, with vertical shafts, and are each capable of delivering into the 48-in. mains 400,000 gallons of water per hour at any state of the tide; they are driven by three-phase electric motors, each of 150 H.P. The whole of the circulating-water system is arranged to work as a siphon.

Harton Colliery.

This colliery, situated in the borough of South Shields, near Tyne Dock railway station, is the property of the Harton Coal Co., Ltd., who are also the owners of the St. Hilda, Boldon and Whitburn collieries. The whole of the appliances at the colliery are worked entirely by electricity, no steam power being used for any purpose.

The existing shaft acts as the downcast to the St. Hilda colliery. The new shaft now being sunk will become the upcast for Harton colliery; and the new shaft which is being sunk at Westoe will be the upcast for St. Hilda colliery. The existing shaft is 14 ft. in diameter, and is sunk to the Bensham Seam, a depth of 1,284 ft. from the surface. The new shaft is to have a finished diameter of 16 ft., and it is intended to sink it also to the Bensham Seam.

The seams at present being worked are the Bensham and Hutton, the output of the colliery being about 1,200 tons per day of 10 hours. The electrical winding-engine, which has just been erected, is, however, designed to deal with an output of 240 tons per hour.

The motor is of 800 B.H.P. normal capacity, with a maximum output, when starting, of 1,700 H.P. at 5,500 volts. The motor works at a speed of 51·8 revolutions per minute, and is coupled direct to the winding-drum, which is 14 ft. in diameter by 8 ft. in width. The brakes on the drum are operated by means of compressed air at a pressure of 60 lb., and can be applied in three ways, namely:—(1) By the winding-engineman, by means of an operating lever; (2) automatically by the depth-indicator, in the event of an overwind; and (3) by an auxiliary magnet, in case of failure of the electrical energy.

Round winding-ropes are used, 5⅞ in. in circumference, made of best extra improved plough steel, with a breaking-strain of about 145 tons.

The balance-rope is flat, 8½ in. in width, and weighs about 4¾ tons, which is 1½ tons heavier than the winding-rope. The engine draws coals from the Bensham Seam level.

The cages in use have four decks, and carry two tubs on each deck. The total weight on the loaded rope at starting, including the rope, cage, tubs, coal, &c., is 14¾ tons; the net weight of the coal raised at each wind is 4½ tons. The time occupied per wind is 48 seconds. The guides are of pitch-pine.

The following engines are placed underground, and are electrically driven:—

There are two principal haulage-engines, one in the Bensham and one in the Hutton Seam, which are worked on the main-and-tail system. Each is driven by a 250-600-H.P. motor working under 2,600 volts at 230 revolutions per minute. The drums of the engines are each 6 ft. in diameter, and are geared at 4½ to 1. The speed of the set is about 10 miles per hour.

The sidings for these haulages are situated 1,050 ft. from the shafts, and two small haulage gears are used to bring the coals from them to the onsetting station.

There are also several auxiliary haulages. One in the Hutton Seam is driven by a 60-H.P. motor at 2,700 volts; it is placed ¾ mile from the shaft, and brings tubs from the different flats to the main hauler; the speed of the set is 6 miles per hour. In the new Hutton Seam there is a small endless-rope gear, driven by a 15-H.P. motor at 600 volts; and the speed of the set is 1½ miles per hour.

At the top of the staple is a small main-and-tail haulage gear, the motor being of 15 H.P. at 600 volts, and the speed of the set 5 miles per hour.

In the Hutton Seam, South-east District, is a main-and-tail haulage gear, driven by a 60-H.P. motor at 2,600 volts. It is situated 1⅜ miles from the shaft, and the speed of the set is 6 miles per hour.

There are exactly similar haulage gears in the South Winnings and Holder House in the Bensham Seam Districts.

In the South-west Cross-cuts District is a small endless-rope gear, driven by a 15-H.P. motor at 600 volts, the speed of the set being 1½ miles per hour.

In the North Drift District a small main-drum gear is installed, the motor being of 15 H.P. at 600 volts.

These auxiliary haulages haul the coals from the flats to the main hauling engine roads, so as to avoid the use of driving ponies; only four driving ponies are employed in the pit.

Figs. 1 and 2 are plans respectively of the engine-planes in the Hutton and Bensham Seams.

A small electrical winding-gear is installed, winding coals from the New Hutton Seam to the Bensham Seam level, a distance of 132 ft. This is worked by a 35-H.P. motor at 600 volts, and winds one tub at each lift.

The whole of the water is pumped from the face by means of small electrically-driven pumps, and is raised from the Bensham Seam to bank by a Sulzer four-stage high-lift centrifugal pump of a capacity of 1,000 gallons per minute, against a head of 1,380 ft. when working at 2,300 R.P.M. The pump is direct coupled to a 650-H.P. Brown-Boveri motor, working at 2,700 volts.

A spare and stand-by pumping plant is also installed, consisting of a motor of 140 H.P., working at 480 R.P.M. at 2,600 volts; and a horizontal three-throw pump, with three rams, each 9 in. in diameter with 18-in. stroke, making 24 R.P.M., and capable of pumping 300 gallons per minute against a vertical head of 1,300 ft.

The headgears and pulley frames are constructed of steel, being of the lattice-girder pattern, and they have been recently erected. The pulleys are made of cast-iron, and are 16 ft. in diameter, the pulley centres being 102 ft. from the surface.

Creepers and gravitation roads are employed on the surface to conduct the tubs from the shaft-mouth to the tipplers leading to the screens; the empty tubs afterwards gravitate back to the cage. A similar arrangement is in operation at the bottom of each shaft. The tubs on all four decks of the cage are simultaneously discharged, no movement of the cage being necessary when it has been brought to a standstill. The motors driving the creepers are of 7½ H.P., and work at 1,120 R.P.M. at 600 volts.

These consist of three main belts, 5 ft. wide, formed of steel plates, varying in length from 48¼ to 63¼ ft. × 4 ft. The subsidiary belts for nuts and small-coal are 3 ft. wide × 52 ft. and 46 ft. in length respectively. The two motors driving the screening appliances are each of 35 H.P. and work at 480 R.P.M. at 600 volts.

The lamp room is of a suitable capacity for cleaning, examining, repairing and storing upwards of 850 safety lamps; these are electrically lighted and magnetically locked, by means of patent devices.

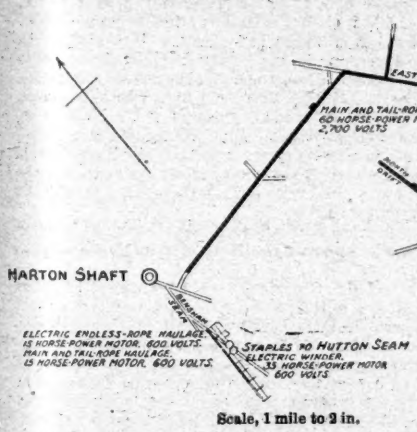
The motor driving the granary plant is of 15 H.P., and the horse-food for the whole of the company's collieries is suitably crushed, chopped, mixed and cleaned at Harton colliery.

The following are particulars of the electric sinking engine and plant as used at the Harton Sinking:

Weight of kibble and stones ...	... 3 tons.
Weight of rope (1,300 ft.) ...	... 15 cwt.
Maximum speed of rope ...	... 1,000 ft. per minute.

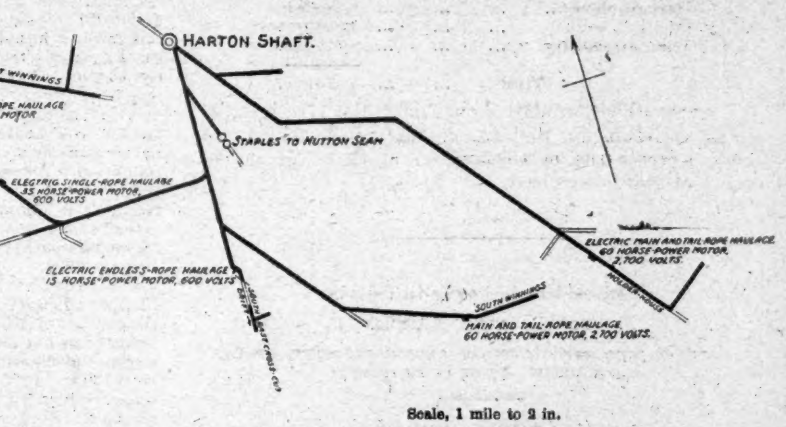
The drum is 6 ft. in diameter over the barrel, 5½ ft. wide, and runs at 51 R.P.M. when at full speed.

The rope is 2¾ in. in circumference, and is of best plough-steel.


EAST WINNINGS
MAIN AND TAIL-ROPE HAULAGE 60 HORSE-POWER MOTOR 2,700 VOLTS
ELECTRIC SINGLE-ROPE HAULAGE 35 HORSE-POWER MOTOR 600 VOLTS
HARTON SHAFT
ELECTRIC ENDLESS-ROPE HAULAGE 15 HORSE-POWER MOTOR, 600 VOLTS.
MAIN AND TAIL-ROPE HAULAGE, 15 HORSE-POWER MOTOR, 600 VOLTS.
STAPLES TO HUTTON SEAM
ELECTRIC WINDER, 35 HORSE-POWER MOTOR 600 VOLTS

Scale, 1 mile to 2 in.

Fig. 1.—Plan showing Engine-planes, &c., in Hutton Seam, Harton Colliery.


HARTON SHAFT.
STAPLES TO HUTTON SEAM
ELECTRIC ENDLESS-ROPE HAULAGE 15 HORSE-POWER MOTOR, 600 VOLTS
ELECTRIC MAIN AND TAIL ROPE HAULAGE, 60 HORSE-POWER MOTOR, 2,700 VOLTS.
SOUTH WINNINGS
MAIN AND TAIL-ROPE HAULAGE, 60 HORSE-POWER MOTOR, 2,700 VOLTS.

Scale, 1 mile to 2 in.

Fig. 2.—Plan showing Engine-planes, &c., in Bensham Seam, Harton Colliery.

The brakes are of the post type, and are operated by compressed air at a pressure of 50 to 60 lb. They are applied by the driver by means of a lever, act automatically in case of failure of supply, and can also be operated by means of a foot lever by the driver.

The drum is geared at 7½ to 1; the gearing is steel and the teeth are machine cut and double helical in shape. The pinion wheel has 18 teeth of 2 in. pitch, and a 12-in. face; the spur-wheel has 134 teeth.

The motor is wound for 2,600 volts, at 40 cycles, and 390 R.P.M; it develops 240 B.H.P. normally and 450 B.H.P. in starting. The gear and motor are mounted on the same bedplate. The controller is of the liquid type, with circulating pump and electrically controlled reversing switch.

The total H.P. of the motors installed is 1,645, exclusive of the winding engine, which is of 800 B.H.P., but capable of exerting 1,700 B.H.P.

The colliery is at present ventilated by means of a Capell fan 11 ft. in diameter by 7 ft. in width (erected at St. Hilda colliery), which is direct driven by means of a 300-H.P. Siemens-Schuckert motor, wound for 5,500 volts at 260 R.P.M. With the fan running at that speed, 210,760 cb. ft. of air per minute are produced at a water-gauge of 5 in. A motor of the same make is installed on the other side of the fan shaft as a stand-by in case of breakdown, this motor being rated at 400 H.P. and running at 295 R.P.M; at this speed the fan will give 250,000 cb. ft. of air at a water-gauge of 6½ in.

An additional ventilating plant is also provided, consisting of a Walker indestructible fan, 26 ft. in diameter by 8 ft. in width, which is driven by compound horizontal engines.

The total horse-power installed at all the collieries of the Harton Coal Co. is as follows:—

Boldon colliery...	1,892 H.P.
Harton colliery...	2,445 H.P.
St. Hilda colliery	1 820 H.P.
Whitburn colliery	2,413 H.P.
Total	8,570 H.P.

The proceedings terminated on Friday, the 17th inst., by a visit to Newbiggin Sinking, another party visiting the Romano-British site of Corstopitum at Corbridge in the county of Northumberland.

Hydro-Electric Power in Canada.

By CECIL B. SMITH, M.Am.Soc.C.E.

(*Abstract of paper read before the* AMERICAN SOCIETY OF CIVIL ENGINEERS, *September 1st*, 1909.)

(*Continued from page* 455.)

THE Winnipeg Street Railway Co. and its allied companies have in operation a hydro-electric station on the Lee Channel of the Winnipeg River, and a transmission line 67 miles long supplying power to a terminal station in the city.

This generating station was selected apparently without proper investigation and without an eye to the future, and the company is already expending large additional sums on the tail-race channel in order to ensure sufficient hydraulic head and flow of water at low water to operate the machinery now installed, which makes a completed scheme incapable of further expansion and consisting of nine units having a combined rated capacity of 14,000 KW.

The generating station has an open forebay, steel-flume wheel-pits, and five 2,000-KW. and four 1,000-KW. units, each operated by two twin horizontal turbines; the generators are for three-phase, 60-cycle, 2,300-volt current.

The transformation is 50,000 volts, and the transformers are oil-insulated, water-cooled, of 1,800-KW. and 830-KW. capacity per phase, each being in a separate compartment. The total transformer capacity at the generating station is 19,500 KW. The transmission system is on double-circuit steel towers, spaced 500 ft. apart, with protruding pieces of angle-iron on each upper corner of each tower, which act as lightning arresters. It is understood that this protection is very satisfactory, there having been only one shut-down during the first year's service (which commenced in 1906). The capacity of the terminal station in Winnipeg is equal to that of the transforming station at the generating works.

The utilities served consist of the city and suburban street railways, the city house-lighting, and current for the present municipally-operated street lighting. In addition to this, there is a small distribution of power for miscellaneous purposes, and two large blocks of power for flour milling. The capacity of the generating station is already fully taxed during the low-water winter season, and no effort is made to encourage large users of power by offering attractive rates. This power station cannot be looked upon as a serious competitor to the municipal power station now being built.

The three tributaries of the Nelson River, which have just been discussed hydraulically, converge in Lake Winnipeg and there form an enormous reservoir of 9,300 sq. miles at an elevation of 710 ft. above the Hudson Sea.

When it is considered that the drainage area feeding the outlet of Lake Winnipeg into the Nelson River proper is nearly 350,000 sq. miles, and that the water supply comes from three different and dissimilar climatic and topographical river basins, one can appreciate what a large minimum flow there is; and as the route of the river to the Hudson Sea is rock-ribbed, in cascades, pools and waterfalls, all that need be said here is that, should electro-chemical or other demands require very extensive water-powers, where relation to habitation is immaterial, these, to the extent of at least 4 500,000 H.P., can be readily secured on the Nelson River between Lake Winnipeg and the Hudson Sea.

Of the many other extensive rivers flowing into the Hudson Sea and James Bay, there is very little accurate information. It can be appreciated, however, from the physical conformation, that many enormous water-powers exist, because the table-land sources of the rivers abound in lakes at an elevation of from 600 to 1,500 ft. above the sea, with a good rainfall. The first development will probably be at Iroquois Falls, on the Abitibi River.

The St. Lawrence River drainage basin is the chief seat of population in Canada, and naturally the hydro electric developments of this region are most extensive.

The total drainage area is 565,000 sq. miles, but of this about 90,000 sq. miles comprise the water surface of the Great Lakes, which form enormous compensating reservoirs, their regulation and control, international in character, presenting a very delicate physical and political question, additionally complicated by the rights and needs of navigation.

The first water-power location on the main river is at Sault Ste. Marie, where Lake Superior, with 31,000 sq. miles of water surface, empties into Lake Huron, falling approximately 18 ft, and discharging about 60,000 cb. ft. per sec. at low water, thereby affording opportunity for about 90,000 E.H.P. The Lake Superior Power Co., with allied companies, disposes of 6,500 H.P. on the Canadian side of the river (out of a designed total of 20,000 H.P.) to rail mills, pulp mills and for industrial and municipal purposes in the Canadian city. On the United States side of the river the same company constructed a canal and power house, designed to obtain 45,000 H.P., but machinery for only one-half of this has been installed. A third company, on the U.S. side, has a small hydro-electric development, but it is probable that no further concessions will be granted there, so that the needs of navigation may be fully conserved. Although these canals and locks serve an enormous commerce, their existence has been of little local value, for the life of the two adjacent cities of Sault Ste. Marie depends chiefly on hydro-electric power, and the two Governments interested will be well advised to use every effort to facilitate the power use of all the water passing from Lake Superior which is not required for locking purposes.

Continuing seaward from Sault Ste. Marie, the next location which affords hydraulic opportunity is spoken of familiarly as Niagara Falls.

Lake Erie flows into Lake Ontario by a river route which, from Chippewa to Queenston, is a series of rapids and a cataract; but the cataract of Niagara Falls is barely one-half of the total difference in elevation, which is 327 ft., and that the first great hydro-electric developments have been made there with effective heads of from 136 ft. to 175 ft. can only be looked upon, in the future, as an economic blunder, because there are potential developments which can be made at several locations in the United States and Canada using a net head as great as 300 ft., which, for as large an installation as 200,000 H.P. or greater, would not be as expensive as those now constructed.

This question of utilising the hydraulic power of the Niagara escarpment is, in reality, a world problem, not a local one, because there is there latent 5,000,000 continuous electrical H.P., considering only the low-water flow of 180,000 cb. ft. per sec. at an effective head of 300 ft., and, estimating even so little as 2½ lb. of coal per H.P.-hour, this would be equivalent to a saving of 55,000,000 tons of coal per year, should this great force of Nature ever become so fully utilised; and why should it not be used in increasing amount as required? There will still be available for scenic purposes all the surplus water, which will still pass over the falls, even after the minimum has all been used for power purposes. This location is unique, as it is on one of the greatest highways of commerce in the world, both water-borne and by rail, and it is in the midst of a fertile and populous region, which, for 150 miles in all directions, is becoming more thickly populated year by year. The steady growth in the electric load carried by the present stations leads to the inevitable conclusion that we are only in the infancy of the utilisation of this great gift of the Creator.

There are six large generating stations, two on the United States side and four on the Canadian side of the river, engaged in producing electrical energy for commercial purposes, and numerous small stations.

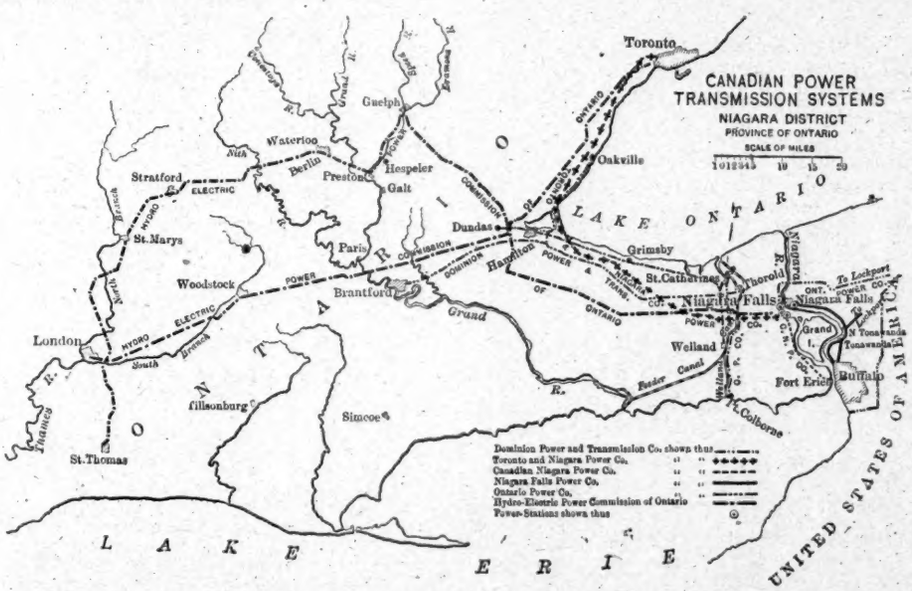
On the United States side the Niagara Falls Hydraulic Power and Manufacturing Co., the first in the field, has 77,500 E.H.P. installed, and building construction is under way for an additional equipment having a capacity of 70,000 E.H.P. In addition to this, water is supplied to various industries developing 8,000 H.P. of direct hydraulic power for pulp, paper, flour, and other mills. The power from these works is used chiefly for the manufacture of aluminium by the Pittsburg Reduction Co. It is understood that this company contracts for nearly 60,000 H.P. The water is used under a total head of 210 ft. and a net head of about 200 ft., and is led down the side of the cliff in steel penstocks to the power stations at the lower river level, where is installed a heterogeneous collection of direct-current and alternating-current generating units of various sizes from 150 to 1,000 KW. in the older station and from 3,500 to 6,500 KW. in the newer station. The business of this station is entirely local.

The Niagara Falls Power Co. has two generating stations, operated under an average effective head of 140 ft. These stations, heralded at the time as pioneers, have long since been eclipsed by the stations on the Canadian side of the river, and also suffer from

certain engineering defects which, no doubt, were unforeseen at the time of construction and have since been cumulative.

The ice difficulties, after years of strenuous effort, have been largely overcome by improvements in the intake works and by the addition of an ice shoot to the tail-race tunnel, but the first station, having a capacity of 50,000 H.P., has unprotected ice racks, and is equipped with free, outward discharge, double runner, vertical turbines. The ten generators are each 5,000 H.P., two-phase, 2,200-volt, with revolving armatures. The second station, having a capacity of 60,000 H.P., has additional submerged-arch entrances and an enclosed forebay for further protection from ice. The turbines are of the single-runner vertical type, with draught-tubes; the 11 generators are each of 5,500 H.P., three-phase, 2,200-volt, and are partly of revolving-field and partly of revolving-armature types. The tail-race tunnels are led from the power stations by very sharp curves to a junction, and this, together with the back-piling in power house No. 1, due to the use of free-discharge wheels, makes it impracticable to run both stations to full capacity. It is understood that 83,000 H.P. is about all that is generated, although the market in Buffalo is being largely abandoned to the Canadian Niagara Power Co., its station being several miles nearer and belonging virtually to the same financial interests.

The power from these stations is now distributed in large blocks, chiefly to local electro-chemical consumers, and the policy of the company in creating a manufacturing district, with railway switching facilities, building sites, &c., and giving long-term power contracts, with guarantees of continuity, under penalty, has created a large and stable industrial centre consuming more than 60,000 H.P. continuously from those two stations. The power is transmitted to Buffalo, Tonawanda, &c., as 22,000-volt, three-phase, 25-cycle current. The pole lines are of ordinary wooden type and carry four three-phase circuits, two on each line, some circuits being of copper and some of aluminium. Until the load was transferred to the Canadian



PLAN SHOWING THE CANADIAN TRANSMISSION SYSTEMS IN THE NIAGARA DISTRICT.

station, all the varied electrical utilities of Buffalo, to the extent of about 40,000 H.P., were operated from these United States stations, as are still the various interurban and scenic electric railways converging at Niagara Falls.

On the Canadian side of the Niagara River four large generating stations have been constructed recently; three of these are at Niagara Falls, and the fourth is at a point 12 miles westward.

The Dominion Power and Transmission Co. (formerly the Hamilton Cataract Power Co.) first commenced to deliver power to Hamilton, Ont., in 1897, from a small station 12 miles westward of Niagara Falls at the foot of the Niagara escarpment, and drawing its water supply from the Welland Canal and thus from Lake Erie.

This hydro-electric development utilises a hydraulic head of 267 ft., and is a very economical one, as excessive expenditures for head-works were not required. This enterprise has a progressive management, and a growing market for power has expanded it until, at the present time, the machinery equipment, including transformers, has a nominal rating of 38,400 H.P.

It is an interesting feature of this generating station that the turbines are entirely of European manufacture and design, being supplied by Italian and German makers, as the earlier experiences with manufacturers in the United States were not satisfactory.

The electric current is generated at 2,400 volts, 66⅔ cycles, and is transmitted to the surrounding towns and cities at various voltages. The chief market is in Hamilton, 32 miles westward, to which three pole-line, three-phase circuits, two of copper and one of aluminium, carry power at 40,000 volts. In addition to this the company serves a network of street and interurban railways which it owns or controls, and supplies power and light in Brantford, Welland, St. Catharines, Dundas, &c., with a total of 132 miles of transmission line.

This company, owing to its favourable investment and strongly entrenched position, is able to distribute with profit at low rates for power, and has thus built up a large business very rapidly. It is understood that the peak load in Hamilton alone, which is a city of only 60,000, is considerably more than 20,000 E.H.P., which includes current for operating street and interurban railways, owned by this company, and also cotton mills, knitting mills, flour mills, rolling mills, and machine shops; in fact, every phase of a busy manufacturing city is provided for.

This company also owns small hydro-electric generating stations at St. Catharines and Brantford, and may be said to control, almost exclusively, the business of supplying electricity in the Niagara District west of Niagara Falls and Thorold.

The generating station of the Canadian Niagara Power Co. was constructed between 1901 and 1905. This company is practically identical with the Niagara Falls Power Co., and although it distributes some 2,000 to 3,000 H.P. locally to various industries in Niagara Falls, Ont., it has not entered the long-distance transmission field. The generating station is of the wheel-pit type, with a tail-race tunnel 2,200 ft. long, and operates under an effective head of only 140 ft. The water is taken from the rapids immediately above the cataract, and although protecting works, submerged-arch entrances, enclosed forebay room, and sluiceways have been constructed to meet the difficult ice conditions, they are only moderately satisfactory, and a continuous winter service is maintained only by strenuous efforts and with considerable difficulty.

The generating works are complete for 11 units, each having a nominal rating of 10,000 E.H.P., and five of these are now installed. The turbines, of Swiss design, are of the vertical type, with draught-tubes and double runners, and the generators are 12,000-volt three-phase, 25 cycle machines.

This station is inter-connected with those of the Niagara Falls Power Co. by a large number of 11,000-volt underground cables, thus warranting great certainty of service; but the chief market for power is in Buffalo. The company has a transformer station, adjoining the generating station, with an equipment of 15 single-phase, 1,250-KW. transformers, all mounted in one room; although these are arranged so as to be operated, if desired, at various voltages up to 60,000, the pressure used at present is 22,000.

The transmission system consists of steel poles, carrying two three-phase circuits of aluminium cable mounted on cellulose insulators, and a third circuit is now being built. The capacity is 12,500 H.P. per circuit at 22,000 volts. At Fort Erie this transmission system has two spans of 1,600 and 2,200 ft., respectively, suspended 130 ft. above the water of the Niagara River, and it is understood that considerable difficulty was experienced in cable breakage until elastic counterweighted suspensions were made at the end towers with suspended insulation at the centre tower.

(To be concluded.)

Water-power in Hungary. — The formation is announced at Fiume of the Adriatic Electricity Co., with a provisional share capital of £166,000, for the purpose of utilising the water-power of the Gacska River, near Ottosac. It is intended shortly to increase the capital to £416,000, whilst a Paris financial group has taken over bonds representing £832,000. The undertaking is to be carried out under the auspices of French engineers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW UNITED STATES TARIFF.—Below we publish an extract from the new United States tariff which came into force on August 6th, 1909, showing the rates of duty now levied on certain goods in which electrical firms in this country may be interested, together with the rates which were formerly levied under the old tariff. One of the most interesting facts in connection with this new tariff is that, although the rates of duty on electrical and other machinery remain unchanged at the rate of 45 per cent. *ad valorem*, and the rates on glassware, earthenware, &c., are similarly unchanged, reductions have been made in the various rates on iron and steel goods almost without exception. This fact is made all the more interesting since the United States is supposed to be essentially a Protectionist country and to have prospered under its protection system. As regards the remainder of the tariff, it may be stated generally that where any alterations have been made they have been in the shape of reductions in the previous rates.

	Old Tariff.	New Tariff.
Mica, rough, unmanufactured or only trimmed	6 c. per lb. & 20 % ad val.	5 c. per lb. & 20 % ad val.
Mica cut or trimmed, mica plates or built-up mica, and all manufactures of mica or of which mica is the component material of chief value	12 c. per lb. & 20 % ad val.	10 c. per lb. & 20 % ad val.
Common yellow, brown or grey earthenware, plain, embossed or salt-glazed, common stoneware and earthenware or stoneware crucibles, all the foregoing not decorated in any manner		25 % ad val.
Yellow earthenware, plain or embossed, coated with white or transparent vitreous glaze, but not otherwise ornamented or decorated, and Rockingham earthenware	(For altered classification see below.)	40 % ad val.
China, porcelain, Parian, bisque, earthen, stone and crockery ware, painted, coloured, &c. ...		60 % ad val.
Ditto, not painted or decorated ...		55 % ad val.
Common yellow, brown or grey earthenware, plain, embossed or salt-glazed common stoneware and crucibles, all the foregoing not decorated in any manner	25 % ad val.	—
Rockingham earthenware not decorated	40 % ad val.	—
China, porcelain, Parian, bisque, earthen, stone and crockery ware:		
Painted, tinted, stained, enamelled, printed, gilded or otherwise decorated or ornamented in any manner ...	60 % ad val.	—
If plain white or without superadded ornamentation of any kind	55 % ad val.	—
All other china, porcelain, Parian, bisque, earthen, stone and crockery ware not specially provided for in this Act:		
If painted, tinted, stained, enamelled, printed, gilded or otherwise decorated or ornamented in any manner ...	60 % ad val.	—
If not ornamented or decorated	55 % ad val.	—
Articles and wares composed wholly or in chief value of earthy or or mineral substances, not specially provided for in this section, whether susceptible of decoration or not:		
If not decorated in any manner	35 % ad val.	35 % ad val.
If decorated	45 % ad val.	45 % ad val.
Carbon, not specially provided for in this section	—	20 % ad val.
Electrodes, brushes, plates and disks, all the foregoing composed wholly or in chief value of carbon	—	30 % ad val.
Carbons for electric lighting, wholly or partly finished:		
Made entirely from petroleum coke	$0·90 per hundred.	100 ft. $0·35
If composed chiefly of lampblack or retort carbon		„ $0·65

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,340. "Electrical divining rod." A. Watson. September 6th.

20,342. "Means by which the swaying and spinning of electric shades are prevented." G. Clarke. September 6th.

20,378. "Improvements in controller-operating handles for electric cars." E. K. Hofmann. (Date applied for under Sec. 91 of the Act, April 8th, 1909, being date of application in United States.) September 6th. (Complete.)

20,408. "Improvements in electro-thermal garments for therapeutic purposes." B. R. Charles. September 6th.

20,413. "Improvements in controlling devices for magnetic clutches." D. Dusseris. September 7th. (Complete.)

20,435. "High-voltage ceiling rose with a detachable plug connection independent of the cover and base." A. H. Shaw. September 7th.

20,474. "Improvements in and relating to electric motors." A. Lehmann. September 7th.

20,496. "Improvements in electric clocks and like mechanism." G. B. Bowell. September 7th.

20,499. "Improvements in electrical switches." H. W. Cox. September 7th.

20,584. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (J. E. Noeggerath, United States.) September 8th.

20,587. "Improvements relating to systems of marine propulsion." A. G. Livesay. September 8th.

20,596. "Improvements in or connected with electric switches." H. R. Slack. September 8th.

20,656. "Improvements in current distributors for the ignition devices of internal-combustion engines." Firm of R. Bosch. (Date applied for under Sec. 91 of the Act, April 7th, 1909, being date of application in Germany.) September 9th. (Complete.)

20,666. "Improvements in shade holders and the like for incandescent electric lights." C. Arnold. September 10th.

20,706. "Improvements in and relating to electric belts." Kuster & Co., G.m.b.H., and F. Metzger. September 10th.

20,743. "Improvements relating to the control of alternating-current electric motors." M. Milch. September 10th.

20,744. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 10th.

20,785. "Improvements connected with dynamo-electric machines and internal combustion or other engines." C. B. Walker. September 11th.

20,786. "Method of and means for making and breaking electrical circuits or contacts." C. B. Walker. September 11th.

20,810. "Electric comb-bell apparatus." G. C. Holyoake. September 11th.

20,815. "Improvements in and relating to electricity meters." Siemens Bros. Dynamo Works, Ltd., and F. Lydall. September 11th.

20,827. "Improvements in and relating to dynamo-electric machinery for starting purposes." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, January 22nd, 1909, being date of application in Germany.) September 11th. (Complete.)

20,830. "System of central station control of the constants of meters on electric supply circuits." J. Zeitlin. September 11th.

20,832. "Carbons for electric arc lamps." K. Weinert. September 11th. (Complete.)

20,839. "Automatic selective switching apparatus suitable for use in telephone exchanges." F. R. McBerty. (Date applied for under Sec. 91 of the Act, August 27th, 1909, being date of application in Austria.) September 11th. (Complete.)

20,840. "Automatic sequence switching device and its control." J. E. Kingsbury. (Western Electric Co., United States.) September 11th. (Complete.)

20,841. "Selector switch suitable for the automatic and selective switching of telephone lines." J. E. Kingsbury. (Western Electric Co., United States.) September 11th. (Complete.)

20,842. "Automatic selective switching apparatus suitable for use in telephone systems." J. E. Kingsbury. (Western Electric Co., United States.) September 11th. (Complete.)

20,843. "Improvements in and relating to the regulation of electrical distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.)

20,845. "Improvements in or relating to electro-magnetic friction brakes." Dick, Kerr & Co., Ltd. (R. Braun, Germany.) September 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Controller Mechanism for Electrically-operated Cranes, Lifts and the like. Allgemeine Elektricitäts Ges. 17,586. August 20th. (Date applied for under International Convention, August 21st, 1907.)

Electric Signalling Systems. H. C. Wilson and C. R. B. Claflin. 17,858. August 25th. (Date applied for under International Convention, August 27th, 1907.)

Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co.) 18,058. August 27th.

Electric Induction Furnaces. Röchling'sche Eisen-und Stahlwerke Ges. and Rodenhauser. 18,513. September 3rd. (Date applied for under International Convention, February 26th, 1908.)

Electric Cranes. J. Marshall, J. Fleming and R. S. Anderson. 21,511. October 9th. (Cognate application, 25,586/08.)

Anti-Vibration Device for Electric Light Pendants and the like. A. Newall. 22,003. October 17th.

Electrical Switches. F. B. Lodge and A. M. Lodge. 23,423. November 3rd.

Apparatus for Enumerating Telephone Calls. G. M. Benington. 23,623. November 5th.

Electro-Galvanising Apparatus specially applicable for Galvanising Rods, Tubes or the like. G. A. Beckett. 24,467. November 14th.

Trolley Head for Electric Cars. C. S. Bayley. 25,758. November 18th.

Detachable Terminal for High and Low-Tension Electric Wires on Motor Vehicles. L. Kirby. 26,420 November 7th.